

CORRECTED VERSION

(19) World Intellectual Property
Organization
International Bureau



(43) International Publication Date
8 January 2004 (08.01.2004)

PCT

(10) International Publication Number
WO 2004/002415 A2

(51) International Patent Classification⁷: **A61K**

CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(21) International Application Number:
PCT/US2003/020322

(22) International Filing Date: 27 June 2003 (27.06.2003)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/392,718 27 June 2002 (27.06.2002) US

(84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

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Published:

— *without international search report and to be republished upon receipt of that report*

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(48) Date of publication of this corrected version:

3 June 2004

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(15) Information about Correction:

see PCT Gazette No. 23/2004 of 3 June 2004, Section II

(81) Designated States (*national*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU,

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: COMPOSITIONS AND METHODS FOR MODULATING A CYTOTOXIC T LYMPHOCYTE IMMUNE RESPONSE

(57) Abstract: The present invention provides compositions and methods for the treatment and prevention of immune disorders.

WO 2004/002415 A2

COMPOSITIONS AND METHODS FOR MODULATING A CYTOTOXIC T LYMPHOCYTE IMMUNE RESPONSE

Related Applications

5

This application claims the benefit of U.S. Provisional Application Serial No. 60/392,718, filed June 27, 2002, the entire contents of which are incorporated herein by this reference.

10 Background of the Invention

The initiation of an immune response against a specific antigen in mammals is brought about by the presentation of that antigen to T lymphocytes. An antigen is presented to T lymphocytes in the context of a major histocompatibility (MHC) complex (also referred to as HLA in humans and H-2 in mice). The three-dimensional structure of the MHC includes a groove or cleft into which the presented antigen fits. When an appropriate receptor on a T lymphocyte interacts with the MHC/antigen complex on an APC in the presence of necessary co-stimulatory signals, the T lymphocyte is stimulated, triggering various aspects of the well characterized cascade of immune system activation events, including induction of cytotoxic T lymphocyte (CTL) function, induction of B lymphocyte function and stimulation of cytokine production (see, *e.g.* Roitt, I and Delves, P. Roitt's Essential Immunology, 10th Ed., Boston, Blackwell Science, 2002; Abbas, A. *et al.* Cellular and Molecular Immunology, W.B. Saunders Company, Philadelphia, 1991; Silverstein, A. A History of Immunology, San Diego, Academic Press, 1989).

There are two basic classes of MHC molecules in mammals, MHC Class I and MHC Class II. Both classes are large complexes formed by association of two separate proteins. MHC Class I molecules present antigen to CD8-positive T lymphocytes, which then become activated and can kill the antigen presenting cell directly. Class I MHC molecules generally receive peptides from endogenously synthesized proteins, such as an infectious virus, in the endoplasmic reticulum at around the time of their synthesis (see, *e.g.*, Williams, A. *et al.* (2002) *Tissue Antigens* 59:3; Konig, R. (2002) *Curr. Opin. Immunol.* 14:75; Anfossi, N. *et al.* (2001) *Immunol. Rev.* 14:75; Gao G. and Jakobsen B (2000) *Immunol. Today* 21:630; Watts,

30

C and Powis, S. (1999) *Rev. Immunogenet.* 1:60 and Natarajan, K. *et al.* (1999) *Rev. Immunogenet.* 1:32).

MHC Class II molecules present antigen to CD4-positive T helper lymphocytes (Th cells). Once activated, Th cells contribute to the activation of CTLs and B lymphocytes via physical contact and cytokine release. Unlike MHC Class I molecules, MHC class II molecules bind exogenous antigens which have been internalized via non-specific or specific endocytosis. Around the time of synthesis, MHC Class II molecules are blocked from binding endogenous antigen, and instead bind the invariant chain protein (Ii). These MHC Class II-Ii protein complexes are transported from the endoplasmic reticulum to a post-Golgi compartment where Ii is released by proteolysis and exogenous antigenic peptides are bound (see, *e.g.*, Villadangos, J. (2001) *Mol. Immunol.* 38:329; Alfonso, C. and Karlsson, L. (2000) *Ann. Rev. Immunol.* 18:113; Viret, C. and Janeway Jr., C. (1999) *Rev. Immunogenet.* 1:91; Diabata *et al.* (1994) *Molecular Immunology* 31:255 and Xu *et al.* (1994) *Molecular Immunology* 31:723).

MHC Class I and MHC Class II molecules have a distinct distribution among cells. Almost all nucleated cells express MHC Class I molecules, although the level of expression varies between cell types. Cells of the immune system express abundant MHC Class I on their surfaces, while liver cells express relatively low levels. Non-nucleated cells express little or no MHC Class I. MHC Class II molecules are highly expressed on B lymphocytes, dendritic cells and macrophages, but not on other tissue cells. However, many other cell types can be induced to express MHC Class II molecules by exposure to cytokines (see, *e.g.* Roitt, I and Delves, P. Roitt's Essential Immunology, 10th Ed., Boston, Blackwell Science, 2002; Abbas, A. *et al.* Cellular and Molecular Immunology, W.B. Saunders Company, Philadelphia, 1991; Silverstein, A. A History of Immunology, San Diego, Academic Press, 1989).

Cytotoxic T lymphocytes (CTLs) are restricted in their activity by recognizing a specific histocompatibility complex (MHC) antigen on the surface of the target cell, as well as a peptide bound in a cleft of the MHC antigen. The foreign antigen may be present as a result of transplantation from an allogeneic host, viral or bacterial infection, mutation, neoplasia, or the like. The involvement of the MHC protein appears to be essential to the attack by CTLs against the cell which includes the

foreign antigen. By monitoring the presence of foreign antigens, the CTLs are able to destroy cells, which if otherwise allowed to proliferate, might result in the proliferation of pathogens or neoplastic cells (see, *e.g.* Roitt, I and Delves, P. Roitt's Essential Immunology, 10th Ed., Boston, Blackwell Science, 2002; Rhodes, D. and
5 Trowsdale, J. (1999) *Rev. Immunogenet.* 1:21; and Yu, C. (1998) *Exp. Clin. Immunogenet.* 15:213).

The unique capability of CTLs to kill infected and/or cancerous cells has led researchers to try and develop strategies for using CTLs in the designing of vaccines for the treatment of diseases, *i.e.* pathogenic infections and cancer. However,
10 vaccines of killed pathogens or soluble proteins are not effective in the induction of the CTL response. Moreover, naked DNA, live vectors and attenuated viruses, which are effective CTL inducers, are genetic material and potentially pose a serious health hazard, especially in the case of viruses such as human immunodeficiency virus (HIV) and Ebola virus (see, *e.g.*, Baba, T. *et al.* (1999) *Nat. Med.* 5:194).

This problem was thought to be solved with the finding that specific T-cell
15 epitopes could be synthetically designed and produced. Townsend *et al.* demonstrated that epitopes of influenza nucleoprotein could be defined by short synthetic peptides and thus included in potential vaccine candidates (Townsend, A. *et al.* (1986) *Nature* 324:575). However, success using synthetic peptides has been limited. Documented
20 cases that describe the use of synthetic peptides, relating to influenza, Sendai and lymphocyte choriomeningitis viruses, for use in the *in vivo* priming of CTLs have presented many problems (see, *e.g.*, Kast, W. *et al.*, (1991) *Immunol. Lett.* 30:229; Aichele, P. *et al.*, (1990) *J. Exp. Med.* 171:1815; Deres, K. *et al.* (1989) *Nature* 342:561). In each of the above cases, the immunization protocols proved to be
25 cumbersome, requiring either modifications of peptides or multiple immunizations to demonstrate CTL activity, and difficulty in rapidly screening large numbers of candidate substances.

Moreover, the use of single epitopic peptides has been shown to only generate CTL responses in a small group of individuals, *i.e.* those individuals who have
30 matched MHC antigens, thus decreasing the effectiveness and usefulness of the vaccine. Although the use of multiple epitopic peptides has been shown to increase the size of the population who will benefit from the vaccine (Hanke, T and McMichael, A. (2000) *Nat. Med.* 6:951), it remains difficult and labor intensive to

accurately predict from a sequence of an antigenic protein how the protein will be processed and which peptide portions will bind HLA class I molecules and be presented to CTLs.

The present invention provides an effective method of modulating, *e.g.*,
5 inducing, an immune response, *e.g.*, a CTL-mediated immune response, which avoids
may of the problems associated with the previously suggested methods. Specifically,
the present invention allows for the development of vaccines that are capable of
inducing antigen-specific immune responses in subjects of varying genetic
backgrounds without the labor intensive task of determining immunostimulatory
10 epitopes.

Summary of the Invention

The present invention provides, at least in part, methods and compositions for
15 the treatment of immune disorders, such as, for example, viral, bacterial and parasitic
infections, prion diseases, neoplastic diseases and protection against toxins. The
invention is based on the discovery that overlapping synthetic peptide formulations
(OSPFs) of the present invention are able to modulate, *e.g.*, induce, immune
responses, such as cytotoxic T lymphocyte (CTL)-mediated response and antibody-
20 associated immune responses, thus indicating a wide applicability for human and
veterinary applications.

Accordingly, the present invention provides a method of modulating, *e.g.*
inducing, an immune response by administering to a subject, *e.g.*, a vertebrate, such as
a human, an effective amount of an OSPF. The OSPF of the present invention
25 includes a combination of single chain peptides that correspond to an amino acid
sequence of a protein of interest, such that the single chain peptide is a length
represented by Y, wherein Y is at least 7 to (X-1), and X represents the number of
amino acids of the protein of interest, where at least 1 single chain peptide overlaps
with another single chain peptide by a length represented by Z, wherein Z is 1 to (Y-
30 1), such that the length of the single chain peptide is able to be internalized by, *e.g.*,
phagocytosis, receptor-mediated endocytosis, and the like, by a MHC bearing cell,
i.e., a MHC class I- or MHC class II-bearing cell, and be presented by an MHC
molecule to a T cell.

In another embodiment, the OSPFs of the present invention are not overlapping, but instead are adjoining. Therefore, in this embodiment, the OSPF of the present invention includes a combination of single chain peptides that correspond to an amino acid sequence of a protein of interest, such that the single chain peptide is
5 a length represented by Y, wherein Y is at least 7 to (X-1) and X represents the number of amino acids of the protein of interest, such that the length of the single chain peptide is able to be internalized, *e.g.*, phagocytosis, receptor-mediated endocytosis, and the like, by a MHC-bearing cell, *i.e.* a MHC Class I- or MHC Class II-bearing cell, and be presented by an MHC molecule to a T cell.

10 In one embodiment, the immune response is a Th1-mediated immune response, such as a CTL-mediated immune response. In another embodiment, the immune response is a Th2-mediated immune response, such as an antibody-associated immune response.

In one embodiment, Y is at least 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19,
15 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, or 30 amino acids.

In another embodiment, Z is at least 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, or 29 amino acids.

In other aspects, the invention pertains to a method of treating or preventing an OSPF-associated disorder in a subject. The method includes administering to the
20 subject an effective amount of an OSPF of the present invention, thereby treating or preventing the OSPF-associated disorder in the subject. By "OSPF-associated disorder" is meant any disease, disorder or condition which can be treated or prevented through the modulation of an immune response. Examples of OSPF-associated disorders include, but is not limited to, viral infections due to viruses (*e.g.*,
25 Ebola virus, hepatitis C, HIV, *e.g.*, HIV-1 and HIV-2, RSV, monkeypox, and SARS coronavirus, bacterial infections due to bacteria (*e.g.*, anthrax, *Listeria monocytogenes*, *Legionella* and mycobacterium such as tuberculosis), parasitic infections (*e.g.* malaria), protection against toxins (*e.g.*, shigella toxin, toxin botulinum and tetanus toxin), parasitic infections due to parasites (*e.g.*, *Plasmodium*,
30 *Trypanosoma*, *Schistosoma* and *Toxoplasmosis*), prions and neoplastic diseases (*e.g.*, breast, colon, non-small cell lung, head and neck, colorectal, lung, prostate, ovary, renal, melanoma, gastrointestinal (*e.g.*, pancreatic and stomach) cancer and osteogenic sarcoma).

In yet another embodiment, the protein of interest can be any protein associated with an OSPF-associated disorder, including, but not limited to, HIV Gag protein (SEQ ID NO:339); SIV Envelope protein (SEQ ID NO:340); anthrax toxins translocating protein (protective antigen precursor [PA]) (SEQ ID NO:209); Ebola virus nucleoprotein (SEQ ID NO:210); hepatitis C virus (HCV) polyprotein (SEQ ID NO:211); melanoma antigen p15 (SEQ ID NO:212); human Her2/neu protein (SEQ ID NO:213); respiratory syncytial virus (RSV) fusion protein (SEQ ID NO:214); HIV-2 gp41 protein (SEQ ID NO:215); HIV-2 GAG protein (SEQ ID NO:216); HIV-2 envelope (env) protein (SEQ ID NO:217); HIV-1 vpu protein (SEQ ID NO:218); HIV-1 envelope (env) protein (SEQ ID NO: 219); HIV-1 Tat interactive protein 2 (SEQ ID NO:220); HIV-1 reverse transcriptase (SEQ ID NO:221) and HIV-1 nef protein (SEQ ID NO:222); circumsporozoite protein precursor (SEQ ID NO:223); circumsporozoite protein II (SEQ ID NO:224); pertussis-like toxin subunit (SEQ ID NO:225); S. aureus enterotoxin A (SEQ ID NO:226); E. coli enterotoxin A (SEQ ID NO:227); C. difficile enterotoxin A (SEQ ID NO:228); B. cereus enterotoxin A (SEQ ID NO:229); pertussis toxin subunit 3 (SEQ ID NO:230); SARS coronavirus (Frankfurt 1) envelope protein E (SEQ ID No:231); Human metapneumovirus fusion protein (SEQ ID NO:232); SARS coronavirus matrix protein (SEQ ID NO: 233); coronavirus nucleocapsid/protein (SEQ ID NO: 234); and SARS coronavirus (Frankfurt 1) spike protein S (SEQ ID NO: 235). For example, OSPFs for HIV-1 Gag include the peptides set forth as SEQ ID NO:1-122 and/or SEQ ID NO:236-335 and OSPFs for SIV Envelope protein include the peptides set forth as SEQ ID NO:123-206 and/or 336-338.

In another aspect, the invention provides a vaccine for immunizing a subject against an OSPF-associated disorder, wherein the vaccine comprises an OSPF of the present invention and a pharmaceutically-acceptable carrier. In another aspect, the invention provides a pharmaceutical composition comprising an OSPF of the present invention and a pharmaceutically acceptable carrier. In yet another aspect, the invention features a kit for immunizing a subject against an OSPF-associated disorder, wherein the kit comprises an OSPF of the present invention and may further comprise instructions for use.

In yet another aspect, the invention features a vaccine adjuvant which comprises an OSPF of the present invention and a pharmaceutically acceptable carrier which may be used to enhance the efficacy of a vaccine.

5 **Brief Description of the Drawings**

Figures 1a - 1c are graphs depicting the CTL activity induced by OSPF-HIV Gag in BALB/c and C57BL/6 mice.

10 *Figures 2a and 2b* are graphs depicting T cell proliferation induced by OSPF-HIV Gag in BALB/c and C57BL/6 mice

Figures 3a and 3b are graphs depicting the CTL activity induced by OSPF-SIV *ex vivo* by human dendritic cells and autologous PBMCs, as assessed by ELISPOT™ and ⁵¹Cr release assays, respectively.

15 **Detailed Description of the Invention**

Definitions

Before further description of the present invention, and in order that the invention may be more readily understood, certain terms are first defined and
20 collected here for convenience.

The term “overlapping synthetic peptide formulation” or “OSPF” refers to a combination of single chain peptides which correspond to an amino acid sequence of a protein of interest, represented by Y, wherein Y is at least 7 to (X-1) and X represents the number of amino acids of the protein interest where at least 1 single
25 chain peptide overlaps with another single chain peptide by a length represented by Z, wherein Z is 1 to (Y-1). The length of the single chain peptide must be such that internalization, *e.g.*, phagocytosis, receptor-mediated endocytosis, and the like, of the single chain peptide by a MHC-bearing cell, *i.e.* a MHC-Class I- or MHC Class II-bearing cell, can occur. Preferably, the cell is a MHC Class I-bearing cell.
30 Furthermore, the OSPF must be of a length to allow presentation by a MHC molecule to a T cell. In certain embodiments, Y is at least 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29 or 30 amino acids in length. In other

embodiments, the length of Z is at least 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28 or 29 amino acids.

In another embodiment of the invention, the OSPF refers to a combination of single chain peptides that correspond to a protein of interest and are represented by Y, wherein Y is 1 to (X-1), where X represents the number of amino acids of the protein of interest. The length of the single chain peptide must be such that internalization, *e.g.*, phagocytosis, receptor-mediated endocytosis, and the like, of the single chain peptide by a MHC-bearing cell, *i.e.* a MHC Class I- or MHC Class II-bearing cell, can occur. Furthermore, the OSPF must be of a length to allow presentation by a MHC molecule to a T cell. Preferably, the cell is a MHC Class I-bearing cell. In certain embodiments, Y is at least 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29 or 30 amino acids in length.

As used herein, the term "combination" or "a combination of" refers to two or more single chain peptides.

The term "peptide" or "single chain peptide" or "polypeptide" is used in its broadest sense, *i.e.*, any polymer of amino acids (dipeptide or greater) linked through peptide bonds. Thus, the term "peptide" includes proteins, oligopeptides, protein fragments, mutants, fusion proteins and the like. The term "protein" is used herein to designate a naturally occurring polypeptide. Peptides of the present invention can be made synthetically, using techniques that are known in the art, or encoded by a nucleic acid, such as DNA or RNA.

The present invention also includes a recombinant molecule comprising a nucleic acid sequence encoding an OSPF(s), operatively linked to a vector capable of being expressed in a host cell. As used herein, "operatively linked" refers to insertion of a nucleic acid sequence into an expression vector in such a manner that the sequence is capable of being expressed when transformed into a host cell. As used herein, an "expression vector" is an RNA or DNA vector capable of transforming a host cell and effecting expression of an appropriate nucleic acid sequence, preferably replicating within the host cell. An expression vector can be either prokaryotic or eukaryotic, and typically is a virus or a plasmid. Suitable host cells can be any cells that are capable of producing the peptides of the present invention. Such host cells include, but are not limited to, bacterial, fungal, insect and mammalian cells. Host cells of the present invention can also be cells which naturally express an MHC

molecule, or are capable of expressing an MHC molecule, and can produce the peptides of the present invention and present them on a MHC molecule. Suitable host cells also include mammalian cells which express MHC molecules on their cell surface and are capable of stimulating an immune response. Examples include, but
5 are not limited to, T cells and antigen presenting cells, such as B cells, dendritic cells, and macrophages. Other examples include non-immune cells which express MHC class I molecules on the cell surface, and include, but are not limited to, fibroblasts, epithelial cells and endothelial cells.

The term "overlapping synthetic peptide formulation (OSPF)-associated
10 disorder" includes any disease, disorder or condition which can be treated or prevented through the modulation, *e.g.*, up-regulation or down-regulation, of an immune response. In certain embodiments, the immune response is a Th-1-mediated immune response, such as a CTL-mediated immune response. In another
15 embodiment, the immune response is a Th2-mediated immune response, such as an antibody-associated immune response. In certain embodiments, OSPF-associated disorders include disorders in which CTL activity is low, aberrant or absent. In other embodiments, the OSPF-associated disorder is an intracellular infection, *e.g.*, a viral infection, a bacterial infection, a parasitic infection, toxic poisoning, prion disease and a neoplastic disease.

20 The term "protein of interest" refers to any protein associated with an OSPF-associated disorder. Examples of proteins of interest include, but are not limited to, HIV Gag protein (SEQ ID NO:239) SIV Envelope protein (SEQ ID NO:240); anthrax toxins translocating protein (protective antigen precursor [PA]) (SEQ ID NO:209); Ebola virus nucleoprotein (SEQ ID NO:210); hepatitis C virus (HCV) polyprotein
25 (SEQ ID NO:211); melanoma antigen p15 (SEQ ID NO:212); human Her2/neu protein (SEQ ID NO:213); respiratory syncytial virus (RSV) fusion protein (SEQ ID NO:214); HIV-2 gp41 protein (SEQ ID NO:215); HIV-2 GAG protein (SEQ ID NO:216); HIV-2 envelope (env) protein (SEQ ID NO:217); HIV-1 vpu protein (SEQ ID NO:218); HIV-1 envelope (env) protein (SEQ ID NO: 219); HIV-1 Tat interactive
30 protein 2 (SEQ ID NO:220); HIV-1 reverse transcriptase (SEQ ID NO:221) and HIV-1 nef protein (SEQ ID NO:222); circumsporozoite protein precursor (SEQ ID NO:223); circumsporozoite protein II (SEQ ID NO:224); pertussis-like toxin subunit (SEQ ID NO:225); *S. aureus* enterotoxin A (SEQ ID NO:226); *E. coli* enterotoxin A

(SEQ ID NO:227); *C. difficile* enterotoxin A (SEQ ID NO:228); *B. cereus* enterotoxin A (SEQ ID NO:229); pertussis toxin subunit 3 (SEQ ID NO:230); SARS coronavirus (Frankfurt 1) envelope protein E (SEQ ID No:231); Human metapneumovirus fusion protein (SEQ ID NO:232); SARS coronavirus matrix protein (SEQ ID NO: 233); coronavirus nucleocapsid protein (SEQ ID NO: 234); and SARS coronavirus (Frankfurt 1) spike protein S (SEQ ID NO: 235). For example, OSPFs for HIV-1 Gag include the peptides set forth as SEQ ID NO:1-122 and/or SEQ ID NO:236-335 and OSPFs for SIV Envelope protein include the peptides set forth as SEQ ID NO:123-206 and/or 336-338.

The methods of the present invention are effective for preventing, treating or eliminating disease caused by a variety of viruses such as, but not limited to, HIV, *e.g.*, HIV-1 and HIV-2, human herpes viruses, cytomegalovirus (*esp.* Human), Rotavirus, Epstein-Barr virus, Varicella Zoster Virus, hepatitis viruses, such as hepatitis B virus, hepatitis A virus, hepatitis C virus and hepatitis E virus, coronaviruses (*e.g.* SARS coronavirus), orthopoxviruses (*e.g.* monkeypox and smallpox), paramyxoviruses: Respiratory Syncytial virus, parainfluenza virus, measles virus, mumps virus, human papilloma viruses (for example HPV6, 11, 16, 18 and the like), flaviviruses (*e.g.* Yellow Fever Virus, Dengue Virus, Tick-borne encephalitis virus, Japanese Encephalitis Virus) or influenza virus.

The methods of the present invention are effective for preventing, treating or eliminating disease caused by a variety of bacterial organisms, including gram-positive and gram-negative bacteria. Examples include, but are not limited to, *Neisseria* spp, including *N. gonorrhea* and *N. meningitidis*, *Streptococcus* spp, including *S. pneumoniae*, *S. pyogenes*, *S. agalactiae*, *S. mutans*; *Haemophilus* spp, including *H. influenzae* type B, non typeable *H. influenzae*, *H. ducreyi*; *Moraxella* spp, including *M. catarrhalis*, also known as *Branhamella catarrhalis*; *Bordetella* spp, including *B. pertussis*, *B. parapertussis* and *B. bronchiseptica*; *Mycobacterium* spp., including *M. tuberculosis*, *M. bovis*, *M. leprae*, *M. avium*, *M. paratuberculosis*, *M. smegmatis*; *Legionella* spp, including *L. pneumophila*; *Escherichia* spp, including enterotoxic *E. coli*, enterohemorrhagic *E. coli*, enteropathogenic *E. coli*; *Vibrio* spp, including *V. cholera*, *Shigella* spp, including *S. sonnei*, *S. dysenteriae*, *S. flexnerii*; *Yersinia* spp, including *Y. enterocolitica*, *Y. pestis*, *Y. pseudotuberculosis*, *Campylobacter* spp, including *C. jejuni* and *C. coli*; *Salmonella* spp, including *S.*

typhi, *S. paratyphi*, *S. choleraesuis*, *S. enteritidis*; *Listeria* spp., including *L. monocytogenes*; *Helicobacter* spp, including *H. pylori*; *Pseudomonas* spp, including *P. aeruginosa*, *Staphylococcus* spp., including *S. aureus*, *S. epidermidis*; *Enterococcus* spp., including *E. faecalis*, *E. faecium*; *Clostridium* spp., including *C. tetani*, *C.*
 5 *botulinum*, *C. difficile*; *Bacillus* spp., including *B. anthracis*; *Corynebacterium* spp., including *C. diphtheriae*; *Borrelia* spp., including *B. burgdorferi*, *B. garinii*, *B. afzelii*, *B. andersonii*, *B. hermsii*; *Ehrlichia* spp., including *E. equi* and the agent of the Human Granulocytic Ehrlichiosis; *Rickettsia* spp, including *R. rickettsii*; *Chlamydia* spp., including *C. trachomatis*, *C. neumoniae*, *C. psittaci*; *Leptira* spp., including *L.*
 10 *interrogans*; *Treponema* spp., including *T. pallidum*, *T. denticola*, *T. hyodysenteriae*. Preferred bacteria include, but are not limited to, *Listeria*, mycobacteria, mycobacteria (*e.g.*, tuberculosis), Anthrax, Salmonella and *Listeria monocytogenes*.

The methods of the present invention are effective for preventing, treating or eliminating disease caused by a variety of protozoal and parasitic organisms such as,
 15 but not limited to, *Anaplasma*, *Babesia*, *Balantidium*, *Besnoitia*, *Chlamydia*, *Coccidia*, *Cryptosporidium*, *Cytauxzoon*, *Eimeria* *Entamoeba*, *Eperythrozoon*, *Ehrlichia*, *Giardia*, *Haemobartonella*, *Hammondia*, *Isopora*, *Leishmania*, *Neorickettsia*, *Plasmodium*, *Pneumocystis*, *Rickettsia*, *Schistosoma*, *Sarcocystis*, *Theileria*, *Thrichinella*, *Toxoplasma*, *Trichomonas*, *Trypanosoma*, *Unicaria*, *Dipylidium*,
 20 *Echinococcuse*, *Taenia*, *Ancylostoma*, *Ascaris*, *Enterobius*, *Strongyloides*, *Strongylus*, *Toxocara*, *Toxascaris* and *Trichuris*. The methods are particularly useful for treating blood-borne protozoal and parasitic diseases.

As used herein, the term "state of toxicity" or "toxin-induced condition" refers to the quality of being poisonous, *i.e.* that caused by a poison or toxin. As used in the
 25 art, this term also refers to the degree of virulence of a toxic microbe or of a poison. By "toxin" it is meant a poisonous substance of biological origin, which necessarily excludes synthetic toxins which are not encoded by a living organism. The toxins are usually, but are not necessarily, proteins. The methods of the present invention for treating and preventing a toxin-related OSPF disorder are effective for preventing,
 30 treating or eliminating toxicity caused by a variety of toxins. Nonlimiting examples of protein toxins include botulin, perfringens toxin, pertussis, mycotoxins, shigatoxins, staphylococcal enterotoxin B, tetanus, ricin, cholera, aflatoxins, diphtheria, T2, seguitoxin, saxitoxin, abrin, cyanoginosin, alphatoxin, tetrodotoxin,

aconotoxin, snake venom, scorpion venom and other spider venoms. A nonlimiting example of a non-protein toxin is tricothecene (T-2). Toxin-producing microorganisms of interest include, but are not limited to: *Corynebacterium diphtheriae*, *Staphylococci*, *Salmonella typhimurium*, *Shigellae*, *Pseudomonas aeruginosa*, *Vibrio cholerae*, *Clostridium botulinum*, and *Clostridium tetani*. A nonlimiting example of a toxin producing plant is *Ricinus communis*, and of a fungus producing a toxin is *Aspergillus favus*.

The methods of the present invention are effective for preventing, treating or eliminating disease caused by prions, such as, but not limited to, familial Creutzfeldt-Jakob disease, Gerstmann-Straussler-Scheinker disease, bovine spongiform encephalopathy (BSE), scrapie and fatal familial Insomnia. As used herein, the term "prion" or "prion disease" refers to a group of transmissible spongiform encephalopathies or TSE. TSEs are caused by abnormalities of the prion protein (PrP). For example, Creutzfeldt-Jakob disease is caused by the conversion of the normal protease-sensitive PrP isoform, designated PrP(C), to a protease resistant isoform, designated PrP(Sc). The change of PrP(C) into PrP(Sc) can occur spontaneously, however, it can also be induced by PrP(Sc). PrP(Sc) forms into an infectious particle, named a 'prion' that can transmit the disease. The process by which prions proceed to the central nervous system (CNS) following peripheral uptake is referred to as neuroinvasion. Accumulation of PrP(Sc) in the brain causes degenerative disorders affecting the CNS leading to neurodegeneration.

As used herein, the term "neoplastic disease" is characterized by malignant tumor growth or in disease states characterized by benign hyperproliferative and hyperplastic cells. The common medical meaning of the term "neoplasia" refers to "new cell growth" that results as a loss of responsiveness to normal growth controls, e.g., neoplastic cell growth.

As used herein, the terms "hyperproliferative", "hyperplastic", "malignant" and "neoplastic" are used interchangeably, and refer to those cells in an abnormal state or condition characterized by rapid proliferation or neoplasia. The terms are meant to include all types of hyperproliferative growth, hyperplastic growth, cancerous growths or oncogenic processes, metastatic tissues or malignantly transformed cells, tissues, or organs, irrespective of histopathologic type or stage of invasiveness. A "hyperplasia" refers to cells undergoing an abnormally high rate of growth. However,

as used herein, the terms neoplasia and hyperplasia can be used interchangeably, as their context will reveal, referring generally to cells experiencing abnormal cell growth rates. Neoplasias and hyperplasias include "tumors," which may be either benign, premalignant or malignant.

5 The terms "neoplasia," "hyperplasia," and "tumor" are often commonly referred to as "cancer," which is a general name for more than 100 diseases that are characterized by uncontrolled, abnormal growth of cells. Examples of cancer include, but are not limited to: breast; colon; non-small cell lung, head and neck; colorectal; lung; prostate; ovary; renal; melanoma; and gastrointestinal (*e.g.*, pancreatic and
10 stomach) cancer; and osteogenic sarcoma.

 The term "tumor antigen" as used herein relates to any antigen expressed on a tumor cell, including but not limited to, Mucin1, carcinoembryonic antigen, oncofetal antigens and tumor-associated antigens. Also included in this definition are any antigens expressed by tumor cells that are encoded by a single DNA strand.

15 The terms "induce", "inhibit", "potentiate", "elevate", "increase" "decrease" or the like, denote quantitative differences between two states, refer to at least statistically significant differences between the two states. For example, "an amount effective to inhibit growth of hyperproliferative cells" means that the rate of growth of the cells will at least statistically significantly different from the untreated cells. Such
20 terms are applied herein to, for example rates of cell proliferation.

 As used herein, the term "subject" is intended to include all vertebrates, *i.e.* human and non-human animals. The term "non-human animals" of the invention includes, but is not limited to, mammals, rodents, mice, and non-mammals, such as non-human primates, sheep, dog, horse, cow, chickens, amphibians, reptiles and the
25 like. In one embodiment, the subject is a mammal, *e.g.*, a primate, *e.g.*, a human. In another embodiment, human animals include a human patient suffering from or prone to suffering from an OSPF-associated disorder.

 The term "treatment" or "treating" as used herein refers to either (1) the prevention of a disease or disorder (prophylaxis), or (2) the reduction or elimination
30 of symptoms of the disease or disorder (therapy).

 The terms "prevention", "prevent" or "preventing" as used herein refers to inhibiting, averting or obviating the onset or progression of a disease or disorder (prophylaxis).

As used herein, the terms “immune” and “immunity” refers to the quality or condition of being able to resist a particular disease.

The terms “immunize” and “immunization,” as used herein, refer to the act of making a subject (1) not susceptible to a disease or disorder; or (2) less responsive to
5 a disease or disorder; or (3) have an increased degree of resistance to a disease or disorder.

The term “MHC-bearing cell” refers to any cell which expresses an MHC molecule, *i.e.* MHC Class I or Class II molecule, on the cell surface. In humans, almost all nucleated cells express MHC Class I molecules, although the level of
10 expression varies between cell types. Cells of the immune system express abundant MHC Class I on their surfaces, while liver cells express relatively low levels. MHC Class II molecules are primarily expressed on immune cells, particularly antigen presenting cells, *i.e.*, B cells, dendritic cells, monocytes and macrophages. However, many other cell types can be induced to express MHC Class II molecules and are also
15 meant to be within the scope of the invention. MHC molecules often have different names between vertebrates. For example, MHC is often referred to as HLA in humans and H-2 in mice. These differences in nomenclature are intended to be within the scope of the present invention.

The term “immune cell” includes cells of the immune system which are capable
20 of expressing, producing or secreting cytokines that regulate an immune response, for example a type-1 (Th1) or type-2 (Th2) immune response. Preferred immune cells include human immune cells. Exemplary preferred immune cells include, but are not limited to, macrophages, dendritic cells, T cells, B cells and neutrophils.

As used herein, the term “T cell” (*i.e.* T lymphocytes) is intended to include
25 all cells within the T cell lineage, including thymocytes, immature T cells, mature T cells (including T cells bearing the surface markers CD4 and/or CD8) and the like, from a mammal (*e.g.* human or mouse). Preferably, the T cell is a CD8⁺ T cell, also referred to herein as a “cytotoxic T lymphocyte” or “CTL”, or a CD4⁺ T cell, also referred to herein as a “helper T lymphocyte” or “Th lymphocyte”. MHC Class II
30 molecules present antigen to CD4⁺ Th cells and once activated, Th cells contribute to the activation of CTLs and B lymphocytes via physical contact and cytokine release.

As used herein, “cytotoxicity” or “induce the killing” of an infected cell or hyperproliferative cell, *e.g.* neoplastic cell, *e.g.* benign hyperplastic cell, refers to the

partial or complete elimination of such cells by a CD8⁺ T cell (or CTL), and does not necessarily indicate a total elimination of the infection or neoplastic growth.

The term "cytokine" is meant to include any one of the group of hormone-like mediators produced by T and B lymphocytes. Representative cytokines include but
5 are not limited to Interleukin-1 (IL-1), IL2, IL3, IL4, IL-5, IL-6, IL-7, IL-8, IL-9, IL-10, IL-11, IL-12, IL-13, IL-15, IL-18, Interferon gamma (IFN- γ), Tumor Necrosis Factor alpha (TNF- α), and Transforming Growth Factor-beta (TGF- β). An "active" fragment of a cytokine is a fragment of a cytokine that retains activity as determined using standard *in vitro* and *in vivo* assays. For example, assays for determining IL2
10 and IFN- γ activity are known in the art (See *e.g.* Campos, M. (1989) *Cell. Immun.* 120:259-269 and Czarniecki, C. W. (1986) *J. Interferon Res.* 6:29-37.) Assays for determining the activity of other cytokines are known and can readily be conducted by those having ordinary skill in the art.

The term "immune response" includes any response associated with immunity
15 including, but not limited to, increases or decreases in cytokine expression, production or secretion (*e.g.*, IL-12, IL-10, TGF β or TNF α expression, production or secretion), cytotoxicity, immune cell migration, antibody production and/or immune cellular responses. The phrase "modulating an immune response" or "modulation of an immune response" includes upregulation, potentiating, stimulating, enhancing or
20 increasing an immune response, as defined herein. For example, an immune response can be upregulated, enhanced, stimulated or increased directly by use of a modulator of the present invention (*e.g.*, a stimulatory modulator). Alternatively, a modulator can be used to "potentiate" an immune response, for example, by enhancing, stimulating or increasing immune responsiveness to a stimulatory modulator. The
25 phrase "modulating an immune response" or "modulation of an immune response" also includes downregulation, inhibition or decreasing an immune response as defined herein.

Immune responses in a subject or patient can be further characterized as being either type-1 or type-2 immune responses.

30 A "type-1 immune response", also referred to herein as a "type-1 response" or a "T helper type 1 (Th1) response" includes a response by CD4⁺ T cells that is characterized by the expression, production or secretion of one or more type-1 cytokines and that is associated with delayed type hypersensitivity responses. The

phrase "type-1 cytokine" includes a cytokine that is preferentially or exclusively expressed, produced or secreted by a Th1 cell, that favors development of Th1 cells and/or that potentiates, enhances or otherwise mediates delayed type hypersensitivity reactions. Preferred type-1 cytokines include, but are not limited to, GM-CSF, IL-2, IFN- γ , TNF- α , IL-12, IL-15 and IL-18.

Included within a Th1-mediated response is a CTL-mediated immune response. The term "CTL-mediated immune response" includes any response associated with cytotoxic T cell (CD8⁺ T cell) immunity including, but not limited to, increases or decreases in cytokine expression, production or secretion (*e.g.*, IL-2, IL-12, IL-15, or IFN- γ expression, production or secretion), cytotoxicity, immune cell migration, antibody production and/or immune cellular responses. The phrase "modulating a CTL-mediated immune response" or "modulation of a CTL-mediated immune response" includes upregulation, potentiating, stimulating, enhancing or increasing an immune response, as defined herein. For example, a CTL-mediated immune response can be upregulated, enhanced, stimulated or increased directly by use of an OSPF of the present invention (*e.g.*, a stimulatory modulator). Alternatively, an OSPF can be used to "potentiate" a CTL-mediated immune response, for example, by enhancing, stimulating or increasing immune responsiveness to a stimulatory modulator. The phrase "modulating a CTL-mediated immune response" or "modulation of a CTL-mediated immune response" also includes downregulation, inhibition or decreasing a CTL-mediated immune response as defined herein.

The phrase "type-1 immunity" includes immunity characterized predominantly by type-1 immune responses (*e.g.*, cellular cytotoxicity, delayed type hypersensitivity, and/or macrophage activation), by expression, production or secretion of at least one type-1 cytokine and/or expression of a type-1 immunity cytokine profile. The phrase "potentiating or potentiation of a type-1 or type-2 immune response" includes upregulation, stimulation or enhancement of a type-1 or type-2 response, respectively (*e.g.*, commitment of T helper precursors to either a Th1 or Th2 lineage, further differentiation of cells to either the Th1 or Th2 phenotype and/or continued function of Th1 or Th2 cells during an ongoing immune response). For a review of Th1 and Th2 subsets see, for example, Seder and Paul (1994) *Ann. Rev. Immunol.* 12:635-673.

A "type-2 immune response", also referred to herein as a "type-2 response or a "T helper type 2 (Th2) response" refers to a response by CD4⁺ T cells that is characterized by the production of one or more type-2 cytokines and that is associated with humoral or antibody-associated immunity (*e.g.*, efficient B cell, "help" provided by Th2 cells, for example, leading to enhanced modification of certain IgG subtypes and/or IgE). The phrase "type-2 cytokine" includes a cytokine that is preferentially or exclusively expressed, produced or secreted by a Th2 cell, that favors development of Th2 cells and/or that potentiates, enhances or otherwise mediates antibody production by B lymphocytes. Preferred type-2 cytokines include, but are not limited to, IL-4, IL-5, IL-6, IL-10, and IL-13.

As used herein, the term "activity", "biological activity" or "functional activity", refers to an activity exerted by a molecule of the invention *e.g.*, an OSPF, as determined *in vivo*, or *in vitro*, according to standard techniques and/or methods such as those described in the Examples.

15

Embodiments of the Invention

The present invention provides, at least in part, methods and compositions for the treatment of immune disorders, such as, for example, viral, bacterial and parasitic infections, prion disease, neoplastic diseases and protection against toxins. The invention is based on the discovery that overlapping synthetic peptide formulations (OSPFs) of the present invention are able to modulate a cytotoxic T lymphocyte (CTL)-mediated response.

Accordingly, the present invention provides a method of modulating, *e.g.* inducing, an immune response, *i.e.*, a Th1-mediated immune response such as a CTL-mediated immune response or a Th2-mediated immune response and an antibody-associated immune response, by administering to a subject, *e.g.*, a vertebrate, such as a human, an effective amount of an OSPF. The OSPF of the present invention includes a combination, *i.e.*, two or more, of single chain peptides that correspond to an amino acid sequence of a protein of interest, such that the single chain peptide is a length represented by Y, wherein Y is at least 7 to (X-1) and where X is the number of amino acids of the protein of interest, and where at least 1 single chain peptide overlaps with another single chain peptide by a length of Z, wherein Z is 1 to (Y-1),

30

such that the length of the single chain peptide is such that it is able to be internalized by a MHC-bearing cell and can be presented on a MHC molecule to a T cell.

In another embodiment, the OSPF of the present invention includes a combination of single chain peptides that correspond to an amino acid sequence of a protein of interest, such that the single chain peptide is a length represented by Y,
5 wherein Y is at least 7 to (X-1) and where X is the number of amino acids of the protein of interest, such that the length of the single chain peptide is such that it is able to be internalized by a MHC-bearing cell and can be presented on a MHC molecule to a T cell.

10 In a particular embodiment, Y is at least 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, or 30 amino acids.

In another embodiment, the overlap between single chain peptides is at least 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28 or 29 amino acids.

15 The invention also includes several variations of an OSPF. Examples include, but are not limited to, an OSPF alone or in combination with other proteins or peptides, *e.g.*, a single set of OSPFs from one protein of interest; two or more OSPFs from the same organism or tumor, but different proteins of interest; different OSPFs from different proteins of interest from different organisms or tumors; a single set of
20 OSPFs from a protein of interest and a killed or attenuated organism; a single set of OSPFs and a tumor-related protein (*i.e.* a tumor antigen); a single set of OSPFs from a protein of interest one or more antibody epitopic peptides; and a single set of OSPFs and one or more Th-related epitopic peptides.

The number of single chain peptides, the length of single chain peptides, and
25 the amount of overlap between single chain peptides will depend on several characteristics of the protein of interest, including the length. These factors can be determined by one skilled in the art without undue experimentation through the use of commercially available computer programs, such as Potean II™ (Proteus) and SPOT™. This allows for several possible epitopes to be encompassed within the
30 OSPF of the present invention, therefore eliminating the cumbersome and expensive step of epitope identification.

In yet another embodiment, the protein of interest includes, but is not limited to, HIV Gag protein (SEQ ID NO:339); SIV Envelope protein (SEQ ID NO:340);

anthrax toxins translocating protein (protective antigen precursor [PA]) (SEQ ID NO:209); Ebola virus nucleoprotein (SEQ ID NO:210); hepatitis C virus (HCV) polyprotein (SEQ ID NO:211); melanoma antigen p15 (SEQ ID NO:212); human Her2/neu protein (SEQ ID NO:213); respiratory syncytial virus (RSV) fusion protein (SEQ ID NO:214); HIV-2 gp41 protein (SEQ ID NO:215); HIV-2 GAG protein (SEQ ID NO:216); HIV-2 envelope (env) protein (SEQ ID NO:217); HIV-1 vpu protein (SEQ ID NO:218); HIV-1 envelope (env) protein (SEQ ID NO: 219); HIV-1 Tat interactive protein 2 (SEQ ID NO:220); HIV-1 reverse transcriptase (SEQ ID NO:221) and HIV-1 nef protein (SEQ ID NO:222); circumsporozoite protein precursor (SEQ ID NO:223); circumsporozoite protein II (SEQ ID NO:224); pertussis-like toxin subunit (SEQ ID NO:225); S. aureus enterotoxin A (SEQ ID NO:226); E. coli enterotoxin A (SEQ ID NO:227); C. difficile enterotoxin A (SEQ ID NO:228); B. cereus enterotoxin A (SEQ ID NO:229); pertussis toxin subunit 3 (SEQ ID NO:230).); SARS coronavirus (Frankfurt 1) envelope protein E (SEQ ID No:231); Human metapneumovirus fusion protein (SEQ ID NO:232); SARS coronavirus matrix protein (SEQ ID NO: 233); coronavirus nucleocapsid protein (SEQ ID NO: 234); and SARS coronavirus (Frankfurt 1) spike protein S (SEQ ID NO: 235). For example, OSPFs for HIV-1 Gag include the peptides set forth as SEQ ID NO:1-122 and/or SEQ ID NO:236-335 and OSPFs for SIV Envelope protein include the peptides set forth as SEQ ID NO:123-206 and/or 336-338. For example, OSPFs for HIV-1 Gag include the peptides set forth as SEQ ID NO:1-122 and/or SEQ ID NO:236-335 and OSPFs for SIV Envelope protein include the peptides set forth as SEQ ID NO:123-206 and/or 336-338.

25 ***Therapeutic Methods***

The present invention provides for therapeutic methods of treating subjects (*e.g.*, vertebrates, such as humans). In one aspect, the invention pertains to a method of treating an OSPF-associated disorder, *e.g.*, any disease, disorder, or condition which can be treated or prevented by modulating an immune response, *i.e.*, a Th1-mediated immune response such as a CTL-mediated immune response or a Th2-mediated immune response, such as an antibody-associated response, in a subject. In one embodiment, the present invention includes administering to a subject having an

OSPF-associated disorder, an effective amount of an OSPF of the present invention, thereby treating the OSPF-associated disorder in the subject.

Also within the scope of this invention is the administration of an OSPF prophylactically. Administration of an OSPF of the present invention can occur prior
5 to the manifestation of symptoms of an OSPF-associated disorder, such that the disorder is prevented or, alternatively, delayed in its progression. The prophylactic methods of the present invention can be carried out in a similar manner to the therapeutic methods described herein, although dosage and treatment regimens may differ.

10 Accordingly, the present method has therapeutic utility in modulating an immune response. In one embodiment, the present method has therapeutic utility in biasing an immune response towards a Th1-mediated (*i.e.*, CTL-mediated) immune response depending upon the desired therapeutic regimen. In another embodiment, the present invention has therapeutic utility in biasing an immune response towards a
15 Th2-mediated (*i.e.*, antibody-associated immunity). Such methods are particularly useful in diseases such as viral infections (*e.g.*, Ebola virus, hepatitis C, HIV, *e.g.*, HIV-1 and HIV-2, RSV, monkeypox, and SARS coronavirus), bacterial infections (*e.g.*, anthrax, *Listeria monocytogenes*, *Legionella* and mycobacterium such as tuberculosis), parasitic infections (*e.g.* malaria) protection against toxins (*e.g.*,
20 shigella toxin, toxin botulinum and tetanus toxin), prion diseases, and neoplastic diseases (*e.g.*, breast, colon, non-small cell lung, head and neck, colorectal, lung, prostate, ovary, renal, melanoma, gastrointestinal (*e.g.*, pancreatic and stomach) cancer and osteogenic sarcoma).

In another aspect, the invention provides a vaccine for immunizing a subject
25 against an OSPF-associated disorder, wherein the vaccine comprises an OSPF of the present invention, either alone or dispersed in a physiologically acceptable, nontoxic vehicle in an amount is effective to immunize a subject against an OSPF disorder.

The vaccines of the present invention are administered in a manner compatible with the dosage formulation, and in such amount as will be therapeutically effective
30 and immunogenic. The quantity to be administered depends on the subject to be treated, capacity of the subject's immune system to generate a cellular immune response, and degree of protection desired. Precise amounts of active ingredient required to be administered depend on the judgment of the practitioner and are

peculiar to each individual. However, suitable dosage ranges are of the order of about one microgram to about one milligram, preferably about 25 micrograms and more preferably about 30 micrograms active ingredient per kilogram per 70 kilogram individual. Suitable regimes for initial administration and booster shots are also
5 variable, but are typified by an initial administration followed in one or two week intervals by a subsequent injection or other administration. Also within the scope of the invention is the co-administration of an adjuvant in combination with an OSPF of the present invention. Suitable adjuvants include, but are not limited to, IL-2, IL-12, IL-15, alum, Conconvalin A, phorbol esters and Freud's adjuvant.

10 In yet another aspect, the invention features a kit for immunizing a subject against an OSPF-associated disorder wherein the kit comprises an OSPF of the present invention and may further comprise instructions for use.

In yet another aspect, the invention features a vaccine adjuvant which comprises an OSPF of the present invention and a pharmaceutically acceptable carrier
15 which may be used to enhance the efficacy of a vaccine.

Pharmaceutical Compositions and Uses thereof

Another aspect of the present invention provides pharmaceutically-acceptable compositions which comprise an OSPF and a pharmaceutically-acceptable carrier(s),
20 in an amount effective to modulate a CTL-mediated immune response.

In a particular embodiment, the OSPF is administered to the subject using a pharmaceutically-acceptable formulation, *e.g.*, a pharmaceutically-acceptable formulation that provides sustained delivery of the OSPF to a subject for at least 12 hours, 24 hours, 36 hours, 48 hours, one week, two weeks, three weeks, or four weeks
25 after the pharmaceutically-acceptable formulation is administered to the subject.

In certain embodiments, these pharmaceutical compositions are suitable for oral administration to a subject. In other embodiments, as described in detail below, the pharmaceutical compositions of the present invention may be specially formulated for administration in solid or liquid form, including those adapted for the following:
30 (1) oral administration, for example, drenches (aqueous or non-aqueous solutions or suspensions), tablets, boluses, powders, granules, pastes; (2) parenteral administration, for example, by subcutaneous, intramuscular or intravenous injection as, for example, a sterile solution or suspension; (3) topical application, for example,

as a cream, ointment or spray applied to the skin; (4) intravaginally or intrarectally, for example, as a pessary, cream or foam; or (5) aerosol, for example, as an aqueous aerosol, liposomal preparation or solid particles containing the compound.

As used herein, the term "effective amount" includes an amount effective, at
5 dosages and for periods of time necessary, to achieve the desired result, *e.g.*, sufficient to modulate a CTL-mediated immune response. An effective amount of OSPF, as defined herein may vary according to factors such as the disease state, age, and weight of the subject, and the ability of the OSPF to elicit a desired response in the subject. Dosage regimens may be adjusted to provide the optimum therapeutic response. An
10 effective amount is also one in which any toxic or detrimental effects (*e.g.*, side effects) of the OSPF of the present invention are outweighed by the therapeutically beneficial effects.

A therapeutically effective amount of OSPF (*i.e.*, an effective dosage) may range from about 0.001 to 40 $\mu\text{g/kg}$ body weight, preferably about 0.01 to 30 $\mu\text{g/kg}$
15 body weight per 70 kilogram individual. The skilled artisan will appreciate that certain factors may influence the dosage required to effectively treat a subject, including but not limited to the severity of the disease or disorder, previous treatments, the general health and/or age of the subject, and other diseases present. Moreover, treatment of a subject with a therapeutically effective amount of an OSPF
20 can include a single treatment or, can include a series of treatments. In one example, a subject is treated with an OSPF in the range of between about 0.1 to 30 $\mu\text{g/kg}$ body weight, one time per week for between about 1 to 10 weeks, preferably between 2 to 8 weeks, more preferably between about 3 to 7 weeks, and even more preferably for about 4, 5, or 6 weeks. It will also be appreciated that the effective dosage of an
25 OSPF used for treatment may increase or decrease over the course of a particular treatment.

The methods of the invention further include administering to a subject a therapeutically effective amount of an OSPF in combination with another pharmaceutically active compound known to modulate, for example, a CTL-mediated
30 immune responses, *e.g.*, agents such as interleukins (IL) (*e.g.* IL-2, IL-12, IL-15), lipopolysaccharide (LPS), concanavalin A (ConA), phorbol esters, and ionomycin. Other pharmaceutically active compounds that may be used to modulate a TH2-mediated immune response, for example, can be found in *Harrison's Principles of*

Internal Medicine, Thirteenth Edition, Eds. T.R. Harrison *et al.* McGraw-Hill N.Y., NY; and the Physicians Desk Reference 50th Edition 1997, Oradell New Jersey, Medical Economics Co., the complete contents of which are expressly incorporated herein by reference. The OSPF and the pharmaceutically active compound may be
5 administered to the subject in the same pharmaceutical composition or in different pharmaceutical compositions (at the same time or at different times).

The regimen of administration also can affect what constitutes an effective amount. OSPFs of the present invention can be administered to the subject prior to, simultaneously with, or after the administration of the other agent(s). Further, several
10 divided dosages, as well as staggered dosages, can be administered daily or sequentially, or the dose can be proportionally increased or decreased as indicated by the exigencies of the therapeutic situation.

The phrase "pharmaceutically acceptable" is employed herein to refer to those OSPFs of the present invention, compositions containing such compounds, and/or
15 dosage forms which are, within the scope of sound medical judgment, suitable for use in contact with the tissues of human beings and animals without excessive toxicity, irritation, allergic response, or other problem or complication, commensurate with a reasonable benefit/risk ratio.

The phrase "pharmaceutically-acceptable carrier" as used herein means a
20 pharmaceutically-acceptable material, composition or vehicle, such as a liquid or solid filler, diluent, excipient, solvent or encapsulating material, involved in carrying or transporting the subject chemical from one organ, or portion of the body, to another organ, or portion of the body. Each carrier must be "acceptable" in the sense of being compatible with the other ingredients of the formulation and not injurious to the
25 subject. Some examples of materials which can serve as pharmaceutically-acceptable carriers include: (1) sugars, such as lactose, glucose and sucrose; (2) starches, such as corn starch and potato starch; (3) cellulose, and its derivatives, such as sodium carboxymethyl cellulose, ethyl cellulose and cellulose acetate; (4) powdered tragacanth; (5) malt; (6) gelatin; (7) talc; (8) excipients, such as cocoa butter and
30 suppository waxes; (9) oils, such as peanut oil, cottonseed oil, safflower oil, sesame oil, olive oil, corn oil and soybean oil; (10) glycols, such as propylene glycol; (11) polyols, such as glycerin, sorbitol, mannitol and polyethylene glycol; (12) esters, such as ethyl oleate and ethyl laurate; (13) agar; (14) buffering agents, such as magnesium

hydroxide and aluminum hydroxide; (15) alginic acid; (16) pyrogen-free water; (17) isotonic saline; (18) Ringer's solution; (19) ethyl alcohol; (20) phosphate buffer solutions; and (21) other non-toxic compatible substances employed in pharmaceutical formulations.

5 Wetting agents, emulsifiers and lubricants, such as sodium lauryl sulfate and magnesium stearate, as well as coloring agents, release agents, coating agents, sweetening, flavoring and perfuming agents, preservatives and antioxidants can also be present in the compositions.

 Examples of pharmaceutically-acceptable antioxidants include: (1) water
10 soluble antioxidants, such as ascorbic acid, cysteine hydrochloride, sodium bisulfate, sodium metabisulfite, sodium sulfite and the like; (2) oil-soluble antioxidants, such as ascorbyl palmitate, butylated hydroxyanisole (BHA), butylated hydroxytoluene (BHT), lecithin, propyl gallate, alpha-tocopherol, and the like; and (3) metal chelating agents, such as citric acid, ethylenediamine tetraacetic acid (EDTA), sorbitol, tartaric
15 acid, phosphoric acid, and the like.

 Compositions containing an OSPF(s) include those suitable for oral, nasal, topical (including buccal and sublingual), rectal, vaginal, aerosol and/or parenteral administration. The compositions may conveniently be presented in unit dosage form and may be prepared by any methods well known in the art of pharmacy. The amount
20 of active ingredient which can be combined with a carrier material to produce a single dosage form will vary depending upon the host being treated, the particular mode of administration. The amount of active ingredient which can be combined with a carrier material to produce a single dosage form will generally be that amount of the compound which produces a therapeutic effect. Generally, out of one hundred per
25 cent, this amount will range from about 1 per cent to about ninety-nine percent of active ingredient, preferably from about 5 per cent to about 70 per cent, most preferably from about 10 per cent to about 30 per cent.

 Methods of preparing these compositions include the step of bringing into association an OSPF(s) with the carrier and, optionally, one or more accessory
30 ingredients. In general, the formulations are prepared by uniformly and intimately bringing into association an OSPF with liquid carriers, or finely divided solid carriers, or both, and then, if necessary, shaping the product.

Compositions of the invention suitable for oral administration may be in the form of capsules, cachets, pills, tablets, lozenges (using a flavored basis, usually sucrose and acacia or tragacanth), powders, granules, or as a solution or a suspension in an aqueous or non-aqueous liquid, or as an oil-in-water or water-in-oil liquid emulsion, or as an elixir or syrup, or as pastilles (using an inert base, such as gelatin and glycerin, or sucrose and acacia) and/or as mouth washes and the like, each containing a predetermined amount of an OSPF(s) as an active ingredient. An OSPF may also be administered as a bolus, electuary or paste.

In solid dosage forms of the invention for oral administration (capsules, tablets, pills, dragees, powders, granules and the like), the active ingredient is mixed with one or more pharmaceutically-acceptable carriers, such as sodium citrate or dicalcium phosphate, and/or any of the following: (1) fillers or extenders, such as starches, lactose, sucrose, glucose, mannitol, and/or silicic acid; (2) binders, such as, for example, carboxymethylcellulose, alginates, gelatin, polyvinyl pyrrolidone, sucrose and/or acacia; (3) humectants, such as glycerol; (4) disintegrating agents, such as agar-agar, calcium carbonate, potato or tapioca starch, alginic acid, certain silicates, and sodium carbonate; (5) solution retarding agents, such as paraffin; (6) absorption accelerators, such as quaternary ammonium compounds; (7) wetting agents, such as, for example, acetyl alcohol and glycerol monostearate; (8) absorbents, such as kaolin and bentonite clay; (9) lubricants, such as talc, calcium stearate, magnesium stearate, solid polyethylene glycols, sodium lauryl sulfate, and mixtures thereof; and (10) coloring agents. In the case of capsules, tablets and pills, the pharmaceutical compositions may also comprise buffering agents. Solid compositions of a similar type may also be employed as fillers in soft and hard-filled gelatin capsules using such excipients as lactose or milk sugars, as well as high molecular weight polyethylene glycols and the like.

A tablet may be made by compression or molding, optionally with one or more accessory ingredients. Compressed tablets may be prepared using binder (for example, gelatin or hydroxypropylmethyl cellulose), lubricant, inert diluent, preservative, disintegrant (for example, sodium starch glycolate or cross-linked sodium carboxymethyl cellulose), surface-active or dispersing agent. Molded tablets may be made by molding in a suitable machine a mixture of the powdered active ingredient moistened with an inert liquid diluent.

The tablets, and other solid dosage forms of the pharmaceutical compositions of the present invention, such as dragees, capsules, pills and granules, may optionally be scored or prepared with coatings and shells, such as enteric coatings and other coatings well known in the pharmaceutical-formulating art. They may also be formulated so as to provide slow or controlled release of the active ingredient therein using, for example, hydroxypropylmethyl cellulose in varying proportions to provide the desired release profile, other polymer matrices, liposomes and/or microspheres. They may be sterilized by, for example, filtration through a bacteria-retaining filter, or by incorporating sterilizing agents in the form of sterile solid compositions which can be dissolved in sterile water, or some other sterile injectable medium immediately before use. These compositions may also optionally contain opacifying agents and may be of a composition that they release the active ingredient(s) only, or preferentially, in a certain portion of the gastrointestinal tract, optionally, in a delayed manner. Examples of embedding compositions which can be used include polymeric substances and waxes. The active ingredient can also be in micro-encapsulated form, if appropriate, with one or more of the above-described excipients.

Liquid dosage forms for oral administration of the OSPF(s) include pharmaceutically-acceptable emulsions, microemulsions, solutions, suspensions, syrups and elixirs. In addition to the active ingredient, the liquid dosage forms may contain inert diluents commonly used in the art, such as, for example, water or other solvents, solubilizing agents and emulsifiers, such as ethyl alcohol, isopropyl alcohol, ethyl carbonate, ethyl acetate, benzyl alcohol, benzyl benzoate, propylene glycol, 1,3-butylene glycol, oils (in particular, cottonseed, groundnut, corn, germ, olive, castor and sesame oils), glycerol, tetrahydrofuryl alcohol, polyethylene glycols and fatty acid esters of sorbitan, and mixtures thereof.

Besides inert diluents, the oral compositions can also include adjuvants such as wetting agents, emulsifying and suspending agents, sweetening, flavoring, coloring, perfuming and preservative agents.

Suspensions, in addition to the active OSPF(s) may contain suspending agents as, for example, ethoxylated isostearyl alcohols, polyoxyethylene sorbitol and sorbitan esters, microcrystalline cellulose, aluminum metahydroxide, bentonite, agar-agar and tragacanth, and mixtures thereof.

Pharmaceutical compositions of the invention for rectal or vaginal administration may be presented as a suppository, which may be prepared by mixing one or more OSPF(s) with one or more suitable nonirritating excipients or carriers comprising, for example, cocoa butter, polyethylene glycol, a suppository wax or a salicylate, and which is solid at room temperature, but liquid at body temperature and, therefore, will melt in the rectum or vaginal cavity and release the active agent.

Compositions of the present invention which are suitable for vaginal administration also include pessaries, tampons, creams, gels, pastes, foams or spray formulations containing such carriers as are known in the art to be appropriate.

Dosage forms for the topical or transdermal administration of an OSPF(s) include powders, sprays, ointments, pastes, creams, lotions, gels, solutions, patches and inhalants. The active OSPF(s) may be mixed under sterile conditions with a pharmaceutically-acceptable carrier, and with any preservatives, buffers, or propellants which may be required.

The ointments, pastes, creams and gels may contain, in addition to OSPF(s) of the present invention, excipients, such as animal and vegetable fats, oils, waxes, paraffins, starch, tragacanth, cellulose derivatives, polyethylene glycols, silicones, bentonites, silicic acid, talc and zinc oxide, or mixtures thereof.

Powders and sprays can contain, in addition to an OSPF(s), excipients such as lactose, talc, silicic acid, aluminum hydroxide, calcium silicates and polyamide powder, or mixtures of these substances. Sprays can additionally contain customary propellants, such as chlorofluorohydrocarbons and volatile unsubstituted hydrocarbons, such as butane and propane.

The OSPF(s) can be alternatively administered by aerosol. This is accomplished by preparing an aqueous aerosol, liposomal preparation or solid particles containing the compound. A nonaqueous (*e.g.*, fluorocarbon propellant) suspension could be used. Sonic nebulizers are preferred because they minimize exposing the agent to shear, which can result in degradation of the compound.

Ordinarily, an aqueous aerosol is made by formulating an aqueous solution or suspension of the agent together with conventional pharmaceutically-acceptable carriers and stabilizers. The carriers and stabilizers vary with the requirements of the particular compound, but typically include nonionic surfactants (Tweens, Pluronics, or polyethylene glycol), innocuous proteins like serum albumin, sorbitan esters, oleic

acid, lecithin, amino acids such as glycine, buffers, salts, sugars or sugar alcohols. Aerosols generally are prepared from isotonic solutions.

Transdermal patches have the added advantage of providing controlled delivery of an OSPF(s) to the body. Such dosage forms can be made by dissolving or
5 dispersing the agent in the proper medium. Absorption enhancers can also be used to increase the flux of the active ingredient across the skin. The rate of such flux can be controlled by either providing a rate controlling membrane or dispersing the active ingredient in a polymer matrix or gel.

Ophthalmic formulations, eye ointments, powders, solutions and the like, are
10 also contemplated as being within the scope of this invention.

Pharmaceutical compositions of this invention suitable for parenteral administration comprise one or more OSPF(s) in combination with one or more pharmaceutically-acceptable sterile isotonic aqueous or nonaqueous solutions, dispersions, suspensions or emulsions, or sterile powders which may be reconstituted
15 into sterile injectable solutions or dispersions just prior to use, which may contain antioxidants, buffers, bacteriostats, solutes which render the formulation isotonic with the blood of the intended recipient or suspending or thickening agents.

Examples of suitable aqueous and nonaqueous carriers which may be employed in the pharmaceutical compositions of the invention include water, ethanol,
20 polyols (such as glycerol, propylene glycol, polyethylene glycol, and the like), and suitable mixtures thereof, vegetable oils, such as olive oil, and injectable organic esters, such as ethyl oleate. Proper fluidity can be maintained, for example, by the use of coating materials, such as lecithin, by the maintenance of the required particle size in the case of dispersions, and by the use of surfactants.

These compositions may also contain adjuvants such as preservatives, wetting
25 agents, emulsifying agents and dispersing agents. Prevention of the action of microorganisms may be ensured by the inclusion of various antibacterial and antifungal agents, for example, paraben, chlorobutanol, phenol sorbic acid, and the like. It may also be desirable to include isotonic agents, such as sugars, sodium
30 chloride, and the like into the compositions. In addition, prolonged absorption of the injectable pharmaceutical form may be brought about by the inclusion of agents which delay absorption such as aluminum monostearate and gelatin.

In some cases, in order to prolong the effect of a drug, it is desirable to slow the absorption of the drug from subcutaneous or intramuscular injection. This may be accomplished by the use of a liquid suspension of crystalline or amorphous material having poor water solubility. The rate of absorption of the drug then depends upon its
5 rate of dissolution which, in turn, may depend upon crystal size and crystalline form. Alternatively, delayed absorption of a parenterally-administered drug form is accomplished by dissolving or suspending the drug in an oil vehicle.

Injectable depot forms are made by forming microencapsule matrices of OSPF(s) in biodegradable polymers such as polylactide-polyglycolide. Depending on
10 the ratio of drug to polymer, and the nature of the particular polymer employed, the rate of drug release can be controlled. Examples of other biodegradable polymers include poly(orthoesters) and poly(anhydrides). Depot injectable formulations are also prepared by entrapping the drug in liposomes or microemulsions which are compatible with body tissue.

15 When the OSPF(s) are administered as pharmaceuticals, to humans and animals, they can be given per se or as a pharmaceutical composition containing, for example, 0.1 to 99.5% (more preferably, 0.5 to 90%) of active ingredient in combination with a pharmaceutically-acceptable carrier.

The term "administration" or "administering" is intended to include routes of
20 introducing the OSPF(s) to a subject to perform their intended function. Examples of routes of administration which can be used include injection (subcutaneous, intravenous, parenterally, intraperitoneally, intrathecal), oral, inhalation, rectal and transdermal. The pharmaceutical preparations are, of course, given by forms suitable for each administration route. For example, these preparations are administered in
25 tablets or capsule form, by injection, inhalation, eye lotion, ointment, suppository, etc. administration by injection, infusion or inhalation; topical by lotion or ointment; and rectal by suppositories. Oral administration is preferred. The injection can be bolus or can be continuous infusion. Depending on the route of administration, the OSPF can be coated with or disposed in a selected material to protect it from natural
30 conditions which may detrimentally effecting its ability to perform its intended function. The OSPF can be administered alone, or in conjunction with either another agent as described above or with a pharmaceutically-acceptable carrier, or both. The OSPF can be administered prior to the administration of the other agent,

simultaneously with the agent, or after the administration of the agent. Furthermore, the OSPF can also be administered in a proform which is converted into its active metabolite, or more active metabolite *in vivo*.

5 The phrases "parenteral administration" and "administered parenterally" as used herein means modes of administration other than enteral and topical administration, usually by injection, and includes, without limitation, intravenous, intramuscular, intraarterial, intrathecal, intracapsular, intraorbital, intracardiac, intradermal, intraperitoneal, transtracheal, subcutaneous, subcuticular, intraarticular, subcapsular, subarachnoid, intraspinal and intrasternal injection and infusion.

10 The phrases "systemic administration," "administered systemically", "peripheral administration" and "administered peripherally" as used herein mean the administration of an OSPF(s), drug or other material, such that it enters the subject's system and, thus, is subject to metabolism and other like processes, for example, subcutaneous administration.

15 Regardless of the route of administration selected, the OSPF(s), which may be used in a suitable hydrated form, and/or the pharmaceutical compositions of the present invention, are formulated into pharmaceutically-acceptable dosage forms by conventional methods known to those of skill in the art.

20 ***Examples***

The invention is further illustrated by the following examples which in no way should be construed as being further limiting.

1. Example 1: HIV and SIV

25 Materials and Methods

A. Peptides

OSPFs corresponding to HIV Gag (SEQ ID NOs:1-122) represent a group of peptides of 15 amino acids in length, with 11-amino acid overlaps between sequential peptides, and spanning the entire HIV Gag protein. Most peptides were approximately
30 80% pure. OSPFs corresponding to SIV Env (SEQ ID NOs:123-206 and/or 336-338), represent a group of peptides of 20 amino acids in length, with 10 amino acid overlaps between sequential peptides, and spanning the entire SIV Env protein. Most peptides are approximately 80% pure.

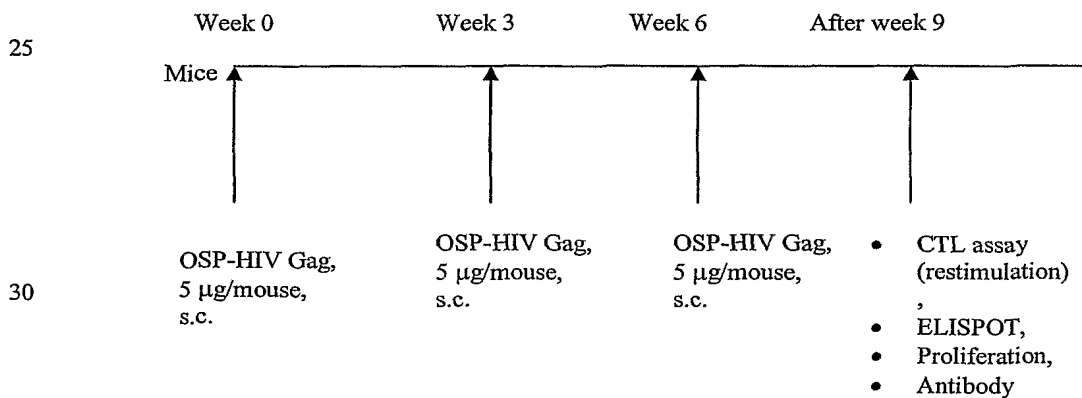
Peptide P7G (AMQMLKETI (SEQ ID NO:207)) is an H-2K^d-restricted CTL epitope of HIV p24 antigen (see, *e.g.*, Doe, B and Walker, C. (1996) *AIDS* 10:793). This peptide was made by the Molecular Biology Core Facilities at the Dana-Farber Cancer Institute (DFCI), and was used as a positive control. The peptide was greater
 5 than approximately 97% pure.

A non-epitope peptide, HIV clade C envelope V3 peptide (GPGQAFYAT (SEQ ID NO:208) made by the Molecular Biology Core Facilities, at Dana Farber Cancer Institute, Boston, MA, was used as a negative control peptide. The peptide
 10 was approximately 97% pure.

B. Mice and Immunization

BALB/c (H-2^d) and C57BL/6 (H-2^b) (Taconic Farms, NY), were immunized
 15 subcutaneously (s.c.) with OSPF-HIV Gag. Each mouse was immunized with 5 µg of each peptide, combined with MLP + TDM Adjuvant System (Sigma, St. Louis, MO; product number M6536. Peptides were >80% pure.). The HIV Gag OSPF was a series of peptides, each 15 amino acids in length, with 11-amino acid overlaps between sequential peptide (NIH AIDS Research and Reference Reagent Program Catalog
 20 #5107). Control mice were given adjuvant alone (mock immunization). The immunization regimen is shown below in Table 1:

Table 1:



C. Blood Donors and Isolation and Differentiation of Blood Dendritic Cells

Leukopacks were provided by anonymous, normal blood donors (Dana-Farber Cancer Institute Blood Bank, Boston, MA). These donors were MHC tissue-typed in Brigham and Women's Hospital (Boston, MA) and shown to have different MHC
5 antigens. Dendritic cells (DC) were isolated and differentiated from peripheral blood mononuclear cells (PBMC). PBMC were cultured in plastic cell-culture flasks and incubated for 2 hrs at 5% CO₂ and 37°C. The adherent cells were collected and incubated in complete RPMI supplemented with interleukin-4 (IL-4) and granulocyte-macrophage colony stimulating factor (GM-CSF) (Stem Cell
10 Technology, Vancouver, Canada) (DC medium). An additional 2 ml of DC medium was added to the culture each day. On day 6, detached cells were collected and transferred into a new flask with fresh DC medium. The purity of the DC cell population was assessed using monoclonal antibodies against specific DC markers (see, *e.g.*, Popov, S., unpublished data). These DC were pulsed overnight with OSPF-
15 SIV Env. The OSPF-SIV Env are a series of peptides of 20 amino acids in length, with 10-amino acid overlaps between sequential peptides (NIH AIDS Research and Reference Reagent Program Catalog #4625). Peptides were >80% pure. DC were irradiated and used to generate CTL *in vitro* by 3 stimulation of autologous PBMC at weekly interval. A CTL assay or ELISPOT was performed one week after the last
20 stimulation.

D. Cytotoxic T Lymphocyte (CTL) Assays

Murine CTL Assays:

For the mouse CTL assay, effector cells were splenic mononuclear cells which
25 were isolated from OSPF- or adjuvant-only immunized mice and restimulated (2×10^6 /ml) *in vitro* with 1 μ M peptide for 7-10 days. Target cells were P815 cells (H-2^d, for BALB/c mice) and EL-4 cells (H-2^b, for B57BL/6 mice). Target cells were labeled with ⁵¹Cr (70 μ Ci/ 2×10^6 cells; Perkin-Elmer, Boston, MA) and pulsed overnight with or without OSPF-HIV Gag (1 μ M), or infected overnight with vaccinia virus [2
30 plaque forming unit (pfu)/target cell] expressing HIVgag (NIH AIDS Research and Reference Reagent Program cat # vP1289), or wild type vaccinia virus (Therion, Cambridge, MA).

In the case of H-2^d restricted CTL, a known CTL epitope from HIV p24 antigen P7G (AMQMLKETI)¹⁹ (SEQ ID NO:207) (> 97% pure, Molecular Biology Core Facilities, Dana Farer Cancer Institute, Boston, MA) was included to test if OSPF-HIV Gag could generate P7G specific (H-2^d restricted) CTL in BALB/c mice.

5 A non-epitopic peptide, HIV clade C envelope V3 peptide (GPGQAFYAT) (SEQ ID NO:208), (> 97% pure, Molecular Biology Core Facilities, Dana Farber Cancer Institute, Boston, MA), was used as negative control peptide.

Effector cells and target cells were co-cultured at different ratios for 6 h, and cytotoxicity was determined by ⁵¹Cr release from target cells (see, *e.g.*, Wunderlich *et al.*, (1997) Current Protocols in Immunology 3.11.1-3.11.20). The percentage specific ⁵¹Cr release was calculated as: 100 (experimental release – spontaneous release)/ (maximum release – spontaneous release). Maximum release was determined from supernatants of cells that were lysed by addition of 5% Triton-X 100. Spontaneous release was determined from the target cells incubated without addition of effector cells.

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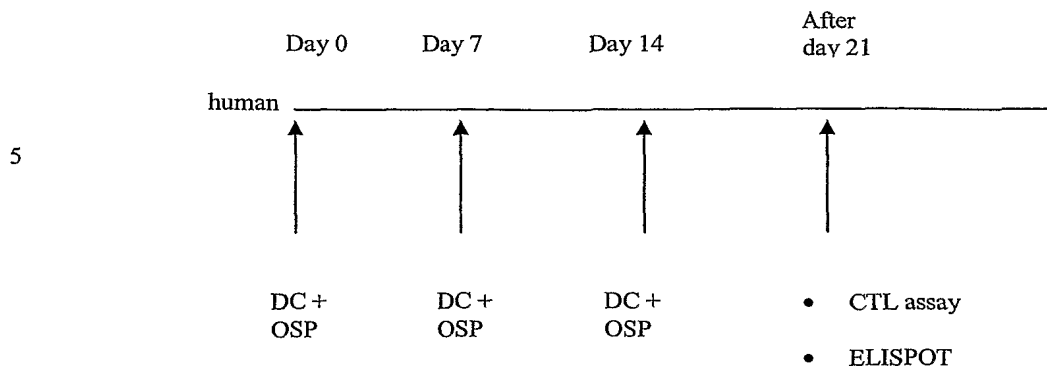
Human CTL Assays:

For the human CTL assay, effector cells were PBMC stimulated with irradiated autologous DC that had been pulsed with or without OSPF cells (see Table 2). Target cells were EBV-transformed, autologous B cell lines. These cells were labeled with ⁵¹Cr (70 µCi/2 x 10⁶ cells; Perkin-Elmer, Boston, MA) and pulsed overnight with or without OSPF-SIV Env (1 µM), or infected overnight with vaccinia virus [2 plaque forming unit (pfu)/target cell] expressing SIV gag-pol-env, or wild type vaccinia virus (Vaccinia virus expressing SIV gag-pol-env and wild type vaccinia virus were obtained from Therion, Cambridge, MA).

20
25

Effector cells and target cells were co-cultured and the percentage specific ⁵¹Cr release was calculated as described above in the mouse CTL assay section (see, *e.g.*, Wunderlich, *et al.*, *supra*).

30

Table 2:

E. ELISPOT™ Assay

Human and mouse ELISPOT assays were performed using ELISPOT kits from BioSource International (Camarillo, CA). Briefly, following the final stimulation, mouse splenocytes or human PBMC stimulated with DC (treated with OSPF and untreated) were seeded into anti-interferon gamma (anti-IFN- γ) monoclonal antibody coated 96-well plates and incubated overnight at 4°C. Subsequently, the cells were discarded and biotinated- anti-IFN- γ antibodies were added for an hour at 37°C followed by another hour of incubation at 37°C with anti-biotin antibody labeled with enzyme. After the color reaction developed, spots were counted under a microscope. Results were expressed as spot forming units (SFU)/10⁶ cells.

F. Lymphocyte Proliferation Assay

Splenic lymphocytes were isolated and cultured at 2×10^6 / ml in RPMI 1640 plus 15 % FCS and antibiotics in the presence of HIV Gag protein (15 ug/ml), OSPF-HIV Gag (3 ug/ml) or ovalbumin (OVA) (15 ug/ml) for 5 days. Four hours prior to harvesting, cells were pulsed with 1 uCi per well of ³H-thymidine. After cells were harvested, ³H-thymidine incorporation was assessed using a β -counter (Beckman). Results were expressed as count per minute (cpm).

Results

A. OSPF-HIV Gag can promiscuously induce CTL responses in genetically different mice

To determine whether OSPF were able to induce CTL responses in genetically different mice, BALB/c (H-2^d) and C57BL/6 (H-2^b) mice were immunized subcutaneously three times at three-week intervals with OSPF-HIV Gag together with an oil-in-water adjuvant system MPL+TDM. CTL activity in both mouse strains against OSPF-HIV Gag was detected by ⁵¹Cr release assays (Figure 1a). No CTL activity was detected in the control mice (adjuvant only). Moreover, these CTLs were also capable of killing target cells infected with vaccinia virus engineered to express HIV Gag (Figure 1b), and, in the case of BALB/c mice, and HIV Gag specific, H-2K^d restricted epitope P7G (Figure 1c). These results suggest that not only are OSPF-HIV Gag able to generate specific CTLs, but these cells are capable of killing cells which express HIV-Gag protein.

15

B. OSPF-HIV Gag can induce proliferative Th cell responses in genetically different mice

To determine whether OSPF are capable of stimulating a proliferative Th cell response, BALB/c and C57BL/6 were immunized with OSPF-HIV Gag as described above. Splenocytes were recovered and cultured *in vitro* with either soluble HIV Gag protein, OSPF-HIV Gag or ovalbumin as a control. The proliferative response was measured by the percentage of ³H-thymidine incorporation (Figure 2). These results demonstrate that OSPF can induce a proliferative Th response and that immunizing with OSPF provides the same proliferative Th-mediated response as does that of the intact protein.

25

C. Ex vivo Induction of Dendritic Cells and Autologous PBMCs of Human Individuals with Different MHC Class I Backgrounds

OSPF that corresponded to SIV Env (OSPF-SIV Env) were used to induce the virus-specific CTL responses *ex vivo* using cells from human blood leukopacks (dendritic cells (DC) and autologous PBMC). OSPF-SIV Env are a group of 87 peptides of 20 amino acids in length, with 10 amino acid overlaps between sequential

30

peptides, and spanning the entire SIV Env protein OSP promiscuously induced CTL in different individuals of different MHC backgrounds.

Cells from two human blood leukopacks from two anonymous donors (d#1 and d#2) were collected and their MHC class I (HLA – A, B, C) were tested [d#1: 5 HLA-A (02, blank); B (08, 18); Bw4 (-,-); Bw6 (+,+); Cw(07, blank). D#2: HLA-A (11, 24); B (39, 51); Bw4 (-,+); Bw6 (+,-); Cw (07, 14). The peripheral blood monocytes (PBMC) were separated and stimulated three times in vitro with irradiated autologous dendritic cells (DC) pulsed with or without OSPF-SIV Env at weekly intervals and ELISPOT and chromium release assays were performed one week after 10 the last stimulation.

These results show that PBMC stimulated with DC pulsed with OSPF-SIV Env generated interferon- γ secreted cells in both d#1 and d#2 (Figure 3a). The chromium release assay showed that target cells transfected with vaccinia virus 15 expressing SIV gag-pol-env were also killed by CTL (Figure 3b). There was no killing when effector and target cells from two leukopacks were mismatched (data not shown), indicating that the APC from the two leukopacks did not present the same epitopes and the killing was MHC restricted.

20

Conclusions

These results show that an individual OSPF can generate CTL activity and proliferative Th cell mediated responses in genetically different strains of mice. Furthermore, OSPF can generate CTL activity in human cells with different HLA 25 subtypes. The data also shows that immunization with OSPF(s) can result in the generation of antigen-specific CTL cells capable of lysing virally-infected cells (*i.e.* cells pulsed with OSPF, target cells infected with vaccinia expressing HIV genes and target cells pulsed with virus-specific epitopic peptide P7G (AMQMLKETI) (SEQ ID NO:207). Thus, since OSPF(s) are capable of generating a Th proliferative response 30 and CTLs in genetically diverse individuals/animals, there is no need to identify specific CTL epitopes.

2. Example 2: RSV

A. Materials and Methods

Potential OSPFs corresponding to RSV fusion protein (SEQ ID NO:214) are shown as follows (The numbered and underlined sequences represent the single chain peptide sequences):

```

MELLILKANA ITTILTAVTF CFASGQNITE EFYQSTCSAV SKGYLSSALRT
10 GWYTSVITIE LSNIKENKCN GTDAKVKLK QELDKYKNAV TELQLLMQST
PPTNNRARRE LPRFMNYTLN NAKKTNTVLS KKRKRRFLGF LLGVGSAIAS
GVAVSKVLHL EGEVNKIKSA LLSTNKAVVS LSNGVSVLTS KVLDLKNYID
15 KOLLPIVNKQ SCSISNIETV IEFQQKNNRL LEITREFSVN AGVTTPVSTY
MLTNSELLSL INDMPITNDQ KKLMSNVQI VRQQSYSIM SIKEEVLAYV
20 VOLPLYGVI DTPCWKLHTSP LCTTNTKEGS NICLTRTDRG WYCDNAGSVS
FFPQAETCKV QSNRVFCDTM NSLTLPSEIN LCNVDIFNPK YDCKKIMTSKT
DVSSSVITSL GAIVSCYGKT KCTASNKNRG IKTFSNGCD YVSNKGMDTV
25 SVGNTLYYVN KQEGKSLYVK GEPINFYDP LVFPSDEFDA SISQVNEKIN
QSLAFIRKSD ELLHNVNAGK STTNIMITTI IIVIIVILLS LIAVGLLLYC
30 KARSTPVTLS KDQLSGINNI AFSN
54 55 (13mer)

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The OSPFs corresponding to the RSV fusion protein represent a group of 55 peptides of 15 amino acids in length, with 5 amino acid overlaps between sequential peptides, and spanning the entire RSV fusion protein.

Examples of other proteins of interest which can be used in the present invention, include, but are not limited to, anthrax toxins translocating protein (protective antigen precursor [PA]) (SEQ ID NO:209); Ebola virus nucleoprotein (SEQ ID NO:210); hepatitis C virus (HCV) polyprotein (SEQ ID NO:211); melanoma antigen p15 (SEQ ID NO:212); human Her2/neu protein (SEQ ID NO:213); HIV-2 gp41 protein (SEQ ID NO:215); HIV-2 GAG protein (SEQ ID NO:216); HIV-2

envelope (env) protein (SEQ ID NO:217); HIV-1 vpu protein (SEQ ID NO:218); HIV-1 envelope (env) protein (SEQ ID NO: 219); HIV-1 Tat interactive protein 2 (SEQ ID NO:220); HIV-1 reverse transcriptase (SEQ ID NO:221) and HIV-1 nef protein (SEQ ID NO:222); circumsporozoite protein precursor (SEQ ID NO:223);
 5 circumsporozoite protein II (SEQ ID NO:224); pertussis-like toxin subunit (SEQ ID NO:225); S. aureus enterotoxin A (SEQ ID NO:226); E. coli enterotoxin A (SEQ ID NO:227); C. difficile enterotoxin A (SEQ ID NO:228); B. cereus enterotoxin A (SEQ ID NO:229); pertussis toxin subunit 3 (SEQ ID NO:230); SARS coronavirus (Frankfurt 1) envelope protein E (SEQ ID No:231); Human metapneumovirus fusion
 10 protein (SEQ ID NO:232); SARS coronavirus matrix protein (SEQ ID NO: 233); coronavirus nucleocapsid protein (SEQ ID NO: 234); and SARS coronavirus (Frankfurt 1) spike protein S (SEQ ID NO: 235).

B. Vaccinia Viruses

15 Vaccinia viruses expressing RSV fusion protein may be utilized and can be made using routine techniques known to those skilled in the art to conduct CTL assays *in vitro*.

C. Mice and Immunization

20 BALB/c (H-2^d) and C57BL/6 (H-2^b) are immunized subcutaneously (s.c.) with OSPF of RSV fusion protein at 5 µg of each individual peptide per mouse together with MLP + TDM Adjuvant system (Sigma, St. Louis, MO; product number M6536. Peptides were >80% pure). Control mice are given only the adjuvant (mock immunization) according to the regimen described in Example 1.

25

D. Blood Donors and Isolation and Differentiation of Blood Dendritic Cells

Leukopacks may be provided by anonymous, normal blood donors. These donors are MHC tissue-typed and dendritic cells isolated and differentiated as previously described above in Example 1.

30

E. Cytotoxic T Lymphocyte (CTL) Assays

Murine CTL Assays:

For the mouse CTL assay, effector cells are splenic mononuclear cells which are isolated from OSPF- or adjuvant-only immunized mice and restimulated (2 x 10⁶/ml) in vitro with 1 µM peptide for 7-10 days. Target cells are P815 cells (H-2^d, for BALB/c mice) and EL-4 cells (H-2^b, for B57BL/6 mice). Target cells are labeled with ⁵¹Cr (70 µCi/2 x 10⁶ cells; Perkin-Elmer, Boston, MA) and pulsed overnight with or without OSPF-RSV fusion protein (1 µM), or infected overnight with vaccinia virus [2 plaque forming unit (pfu)/target cell].

Effector cells and target cells are co-cultured at different ratios for 6 h, and cytotoxicity is determined by ⁵¹Cr release from target cells (see, *e.g.*, Wunderlich *et al.*, (1997) Current Protocols in Immunology 3.11.1-3.11.20). The percentage specific ⁵¹Cr release is calculated as: 100 (experimental release – spontaneous release)/ (maximum release – spontaneous release). Maximum release is determined from supernatants of cells that are lysed by addition of 5% Triton-X 100. Spontaneous release is determined from the target cells incubated without addition of effector cells.

Human CTL Assays:

For the human CTL assay, effector cells are PBMC stimulated with irradiated autologous DC that are pulsed with or without OSPF (see Table 2). Target cells are EBV-transformed, autologous B cell lines. These cells are labeled with ⁵¹Cr (70 µCi/2 x 10⁶ cells; Perkin-Elmer, Boston, MA) and pulsed overnight with or without OSPF RSV fusion protein (1 µM), or infected overnight with vaccinia virus [2 plaque forming unit (pfu)/target cell] expressing SIV gag-pol-env, or wild type vaccinia virus (Vaccinia virus expressing SIV gag-pol-env and wild type vaccinia virus are obtained from Therion, Cambridge, MA).

Effector cells and target cells are co cultured and the percentage specific ⁵¹Cr release is calculated as described above in the mouse CTL assay section (see, *e.g.*, Wunderlich, *et al.*, *supra*).

F. ELISPOT™ Assay

Human and mouse ELISPOT assays are performed using ELISPOT kits from BioSource International (Camarillo, CA). Briefly, following the final stimulation,

mouse splenocytes or human PBMC are stimulated with DC (treated with OSPF and untreated) and seeded into anti-interferon gamma (anti-IFN- γ) monoclonal antibody coated 96-well plates and incubated overnight at 4°C. Subsequently, the cells are discarded and biotinated- anti-IFN- γ antibodies are added for an hour at 37°C
5 followed by another hour of incubation at 37°C with anti-biotin antibody labeled with enzyme. After the color reaction develops, spots are counted under a microscope. Results are expressed as spot forming units (SFU)/10⁶ cells.

G. Lymphocyte Proliferation Assay

10 Splenic lymphocytes are isolated and cultured at 2×10^6 / ml in RPMI 1640 plus 15 % FCS plus antibiotics in the presence of RSV fusion protein (15 ug/ml) or OSPF-RSV fusion protein or ovalbumin (OVA) for 5 days. Four hours before harvesting, cells are pulsed with 1 uCi per well of ³H-thymidine. After cells are harvested, ³H-thymidine incorporation is assessed using a β -counter (Beckman).
15 Results are expressed as count per minute (cpm).

Incorporation by Reference

The contents of all references (including literature references, issued patents,
20 published patent applications, and co-pending patent applications) cited throughout this application are hereby expressly incorporated herein in their entireties by reference.

Equivalents

25 Those skilled in the art will recognize, or be able to ascertain using no more than routine experimentation, many equivalents of the specific embodiments of the invention described herein. Such equivalents are intended to be encompassed by the following claims.

30

CLAIMS

1. A method of modulating an immune response comprising administering to a
5 subject an effective amount of an overlapping synthetic peptide formulation (OSPF),
wherein said OSPF comprises a combination of single chain peptides corresponding
to an amino acid sequence of a protein of interest, wherein said single chain peptide is
a length represented by Y, wherein Y is at least 7 to (X-1) and X is the number of
amino acids of said protein of interest, wherein at least one single chain peptide
10 overlaps with another single chain peptide by a length represented by Z, wherein Z is
1 to (Y-1), wherein said length of said single chain peptide is such that internalization
of said single chain peptide by a MHC-bearing cell and presentation by a MHC
molecule to a T cell is possible, such that said immune response is modulated.
- 15 2. The method of claim 1, wherein said subject is a vertebrate.
3. The method of claim 1, wherein said Y is fifteen (15) amino acids.
4. The method of claim 1, wherein said Z is five (5) amino acids.
- 20 5. The method of claim 1, wherein said immune response is a Th1-mediated immune
response.
6. The method of claim 5, wherein said Th1-mediated immune response is a CTL-
25 mediated immune response.
7. The method of claim 1, wherein said immune response is a Th2-mediated immune
response.
- 30 8. The method of claim 7, wherein said Th2-mediated immune response is an
antibody-associated immune response.

9. The method of claim 1, wherein said MHC-bearing cell is a MHC Class I-bearing cell.
10. The method of claim 9, wherein said MHC Class I-bearing cell is a CTL.
- 5 11. The method of claim 1, wherein said MHC-bearing cell is a MHC Class II-bearing cell.
12. The method of claim 11, wherein said MHC Class II-bearing cell is a B cell.
- 10 13. The method of claim 1, wherein said protein of interest is selected from the group consisting of HIV Gag protein (SEQ ID NO:339); SIV Envelope protein (SEQ ID NO:340); anthrax toxins translocating protein (protective antigen precursor [PA]) (SEQ ID NO:209); Ebola virus nucleoprotein (SEQ ID NO:210); hepatitis C virus (HCV) polyprotein (SEQ ID NO:211); melanoma antigen p15 (SEQ ID NO:212); human Her2/neu protein (SEQ ID NO:213); respiratory syncytial virus (RSV) fusion protein (SEQ ID NO:214); HIV-2 gp41 protein (SEQ ID NO:215); HIV-2 GAG protein (SEQ ID NO:216); HIV-2 envelope (env) protein (SEQ ID NO:217); HIV-1 vpu protein (SEQ ID NO:218); HIV-1 envelope (env) protein (SEQ ID NO: 219); HIV-1 Tat interactive protein 2 (SEQ ID NO:220); HIV-1 reverse transcriptase (SEQ ID NO:221) and HIV-1 nef protein (SEQ ID NO:222); circumsporozoite protein precursor (SEQ ID NO:223); circumsporozoite protein II (SEQ ID NO:224); pertussis-like toxin subunit (SEQ ID NO:225); S. aureus enterotoxin A (SEQ ID NO:226); E. coli enterotoxin A (SEQ ID NO:227); C. difficile enterotoxin A (SEQ ID NO:228); B. cereus enterotoxin A (SEQ ID NO:229); pertussis toxin subunit 3 (SEQ ID NO:230)); SARS coronavirus (Frankfurt 1) envelope protein E (SEQ ID No:231); Human metapneumovirus fusion protein (SEQ ID NO:232); SARS coronavirus matrix protein (SEQ ID NO: 233); coronavirus nucleocapsid protein (SEQ ID NO: 234); and SARS coronavirus (Frankfurt 1) spike protein S (SEQ ID NO: 235).
- 25 30 14. A method of modulating an immune response comprising administering to a subject an effective amount of an overlapping synthetic peptide formulation (OSPF),

wherein said OSPF comprises a combination of single chain peptides corresponding to an amino acid sequence of a protein of interest, wherein said single chain peptides are a length represented by Y, wherein Y at least 7 to (X-1) and X is the number of amino acids of said protein of interest, wherein said length of said single chain peptides is such that internalization of said single chain peptide by a MHC-bearing cell and presentation by a MHC molecule to a T cell is possible, such that said immune response is modulated.

15. The method of claim 14, wherein said subject is a vertebrate.

16. The method of claim 14, wherein said Y is fifteen (15) amino acids.

17. The method of claim 14, wherein said immune response is a Th1-mediated immune response.

18. The method of claim 17, wherein said Th1-mediated immune response is a CTL-mediated immune response.

19. The method of claim 14, wherein said immune response is a Th2-mediated immune response.

20. The method of claim 19, wherein said Th2-mediated immune response is an antibody-associated immune response.

21. The method of claim 13, wherein said MHC-bearing cell is a MHC Class I-bearing cell.

22. The method of claim 21, wherein said MHC Class I-bearing cell is a CTL.

23. The method of claim 14, wherein said MHC-bearing cell is a MHC Class II-bearing cell.

24. The method of claim 23, wherein said MHC Class II-bearing cell is a B cell.

25. The method of claim 14, wherein said protein of interest is selected from the group consisting of HIV Gag protein (SEQ ID NO:339); SIV Envelope protein (SEQ ID NO:340); anthrax toxins translocating protein (protective antigen precursor [PA]) (SEQ ID NO:209); Ebola virus nucleoprotein (SEQ ID NO:210); hepatitis C virus (HCV) polyprotein (SEQ ID NO:211); melanoma antigen p15 (SEQ ID NO:212); human Her2/neu protein (SEQ ID NO:213); respiratory syncytial virus (RSV) fusion protein (SEQ ID NO:214); HIV-2 gp41 protein (SEQ ID NO:215); HIV-2 GAG protein (SEQ ID NO:216); HIV-2 envelope (env) protein (SEQ ID NO:217); HIV-1 vpu protein (SEQ ID NO:218); HIV-1 envelope (env) protein (SEQ ID NO: 219); HIV-1 Tat interactive protein 2 (SEQ ID NO:220); HIV-1 reverse transcriptase (SEQ ID NO:221) and HIV-1 nef protein (SEQ ID NO:222); circumsporozoite protein precursor (SEQ ID NO:223); circumsporozoite protein II (SEQ ID NO:224); pertussis-like toxin subunit (SEQ ID NO:225); S. aureus enterotoxin A (SEQ ID NO:226); E. coli enterotoxin A (SEQ ID NO:227); C. difficile enterotoxin A (SEQ ID NO:228); B. cereus enterotoxin A (SEQ ID NO:229); pertussis toxin subunit 3 (SEQ ID NO:230)); SARS coronavirus (Frankfurt 1) envelope protein E (SEQ ID No:231); Human metapneumovirus fusion protein (SEQ ID NO:232); SARS coronavirus matrix protein (SEQ ID NO: 233); coronavirus nucleocapsid protein (SEQ ID NO: 234); and SARS coronavirus (Frankfurt 1) spike protein S (SEQ ID NO: 235).

26. A pharmaceutical composition comprising an overlapping synthetic peptide formulation (OSPF) and a pharmaceutically acceptable carrier, wherein said OSPF comprises a combination of single chain peptides corresponding to an amino acid sequence of a protein of interest, wherein said single chain peptide is a length represented by Y, wherein Y is at least 7 to (X-1) and X is the number of amino acids of said protein of interest, wherein at least one single chain peptide overlaps with another single chain peptide by a length represented by Z, wherein Z is 1 to (Y-1), wherein said length of said single chain peptide is such that internalization of said single chain peptide by a MHC-bearing cell and presentation by a MHC molecule to a T cell is possible.

27. The pharmaceutical composition of claim 26, wherein said Y is fifteen (15) amino acids.

5 28. The pharmaceutical composition of claim 27, wherein said Z is five (5) amino acids.

29. The pharmaceutical composition of claim 26, wherein said MHC-bearing cell is a MHC Class I-bearing cell.

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30. The pharmaceutical composition of claim 29, wherein said MHC Class I-bearing cell is a CTL.

31. The pharmaceutical composition of claim 26, wherein said MHC-bearing cell is a
15 MHC Class II-bearing cell.

32. The pharmaceutical composition of claim 31, wherein said MHC Class II-bearing cell is a B cell.

20 33. The pharmaceutical composition of claim 26, wherein said protein of interest is selected from the group consisting of HIV Gag protein (SEQ ID NO:339); SIV Envelope protein (SEQ ID NO:340); anthrax toxins translocating protein (protective antigen precursor [PA]) (SEQ ID NO:209); Ebola virus nucleoprotein (SEQ ID NO:210); hepatitis C virus (HCV) polyprotein (SEQ ID NO:211); melanoma antigen
25 p15 (SEQ ID NO:212); human Her2/neu protein (SEQ ID NO:213); respiratory syncytial virus (RSV) fusion protein (SEQ ID NO:214); HIV-2 gp41 protein (SEQ ID NO:215); HIV-2 GAG protein (SEQ ID NO:216); HIV-2 envelope (env) protein (SEQ ID NO:217); HIV-1 vpu protein (SEQ ID NO:218); HIV-1 envelope (env) protein (SEQ ID NO: 219); HIV-1 Tat interactive protein 2 (SEQ ID NO:220); HIV-1
30 reverse transcriptase (SEQ ID NO:221) and HIV-1 nef protein (SEQ ID NO:222); circumsporozoite protein precursor (SEQ ID NO:223); circumsporozoite protein II (SEQ ID NO:224); pertussis-like toxin subunit (SEQ ID NO:225); S. aureus enterotoxin A (SEQ ID NO:226); E. coli enterotoxin A (SEQ ID NO:227); C. difficile

enterotoxin A (SEQ ID NO:228); B. cereus enterotoxin A (SEQ ID NO:229);
pertussis toxin subunit 3 (SEQ ID NO:230)); SARS coronavirus (Frankfurt 1)
envelope protein E (SEQ ID No:231); Human metapneumovirus fusion protein (SEQ
ID NO:232); SARS coronavirus matrix protein (SEQ ID NO: 233); coronavirus
5 nucleocapsid protein (SEQ ID NO: 234); and SARS coronavirus (Frankfurt 1) spike
protein S (SEQ ID NO: 235).

34. A pharmaceutical composition comprising an overlapping synthetic peptide
10 formulation (OSPF) and a pharmaceutically acceptable carrier, wherein said OSPF
comprises a combination of single chain peptides corresponding to an amino acid
sequence of a protein of interest, wherein said single chain peptides are a length
represented by Y, wherein Y is at least 7 to (X-1) and X is the number of amino acids
of said protein of interest, wherein said length of said single chain peptides is such
15 that internalization of said single chain peptide by a MHC -bearing cell and
presentation by a MHC molecule to a T cell is possible.

35. The pharmaceutical composition of claim 13, wherein said Y is fifteen (15)
amino acids.

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36. The pharmaceutical composition of claim 34, wherein said MHC-bearing cell is a
MHC Class I-bearing cell.

37. The pharmaceutical composition of claim 36, wherein said MHC Class I-bearing
25 cell is a CTL.

38. The pharmaceutical composition of claim 34, wherein said MHC-bearing cell is a
MHC Class II-bearing cell.

30 39. The pharmaceutical composition of claim 38, wherein said MHC Class II-bearing
cell is a B cell.

40. The pharmaceutical composition of claim 34, wherein said protein of interest is selected from the group consisting of HIV Gag protein (SEQ ID NO:339); SIV Envelope protein (SEQ ID NO:340); anthrax toxins translocating protein (protective antigen precursor [PA]) (SEQ ID NO:209); Ebola virus nucleoprotein (SEQ ID NO:210); hepatitis C virus (HCV) polyprotein (SEQ ID NO:211); melanoma antigen p15 (SEQ ID NO:212); human Her2/neu protein (SEQ ID NO:213); respiratory syncytial virus (RSV) fusion protein (SEQ ID NO:214); HIV-2 gp41 protein (SEQ ID NO:215); HIV-2 GAG protein (SEQ ID NO:216); HIV-2 envelope (env) protein (SEQ ID NO:217); HIV-1 vpu protein (SEQ ID NO:218); HIV-1 envelope (env) protein (SEQ ID NO: 219); HIV-1 Tat interactive protein 2 (SEQ ID NO:220); HIV-1 reverse transcriptase (SEQ ID NO:221) and HIV-1 nef protein (SEQ ID NO:222); circumsporozoite protein precursor (SEQ ID NO:223); circumsporozoite protein II (SEQ ID NO:224); pertussis-like toxin subunit (SEQ ID NO:225); S. aureus enterotoxin A (SEQ ID NO:226); E. coli enterotoxin A (SEQ ID NO:227); C. difficile enterotoxin A (SEQ ID NO:228); B. cereus enterotoxin A (SEQ ID NO:229); pertussis toxin subunit 3 (SEQ ID NO:230)); SARS coronavirus (Frankfurt 1) envelope protein E (SEQ ID No:231); Human metapneumovirus fusion protein (SEQ ID NO:232); SARS coronavirus matrix protein (SEQ ID NO: 233); coronavirus nucleocapsid protein (SEQ ID NO: 234); and SARS coronavirus (Frankfurt 1) spike protein S (SEQ ID NO: 235).

41. A method of treating an OSPF-associated disorder in a subject comprising administering to a subject an effective amount of an overlapping synthetic peptide formulation (OSPF), wherein said OSPF comprises a combination of single chain peptides corresponding to an amino acid sequence of a protein of interest, wherein said single chain peptide is a length represented by Y, wherein Y is at least 7 to (X-1) and X is the number of amino acids of said protein of interest, and wherein at least one single chain peptide overlaps with another single chain peptide by a length of Z, wherein Z is 1 to (Y-1), wherein said length of said single chain peptide is such that internalization of said single chain peptide by a MHC-bearing cell and presentation by a MHC molecule to a T cell is possible, such that said OSPF-associated disorder is treated in said subject.

42. The method of claim 41, wherein said subject is a vertebrate.
- 5 43. The method of claim 41, wherein said Y is fifteen (15) amino acids.
44. The method of claim 41, wherein said Z is five (5) amino acids.
45. The method of claim 41, wherein said MHC-bearing cell is a MHC Class I-
10 bearing cell.
46. The method of claim 45, wherein said MHC Class I-bearing cell is a CTL.
47. The method of claim 45, wherein said MHC-bearing cell is a MHC Class II-
15 bearing cell.
48. The method of claim 47, wherein said MHC Class II-bearing cell is a B cell.
49. The method of claim 41, wherein said protein of interest is selected from the
20 group consisting of HIV Gag protein (SEQ ID NO:339); SIV
Envelope protein (SEQ ID NO:340); anthrax toxins translocating protein (protective
antigen precursor [PA]) (SEQ ID NO:209); Ebola virus nucleoprotein (SEQ ID
NO:210); hepatitis C virus (HCV) polyprotein (SEQ ID NO:211); melanoma antigen
p15 (SEQ ID NO:212); human Her2/neu protein (SEQ ID NO:213); respiratory
25 syncytial virus (RSV) fusion protein (SEQ ID NO:214); HIV-2 gp41 protein (SEQ ID
NO:215); HIV-2 GAG protein (SEQ ID NO:216); HIV-2 envelope (env) protein
(SEQ ID NO:217); HIV-1 vpu protein (SEQ ID NO:218); HIV-1 envelope (env)
protein (SEQ ID NO: 219); HIV-1 Tat interactive protein 2 (SEQ ID NO:220); HIV-1
reverse transcriptase (SEQ ID NO:221) and HIV-1 nef protein (SEQ ID NO:222);
30 circumsporozoite protein precursor (SEQ ID NO:223); circumsporozoite protein II
(SEQ ID NO:224); pertussis-like toxin subunit (SEQ ID NO:225); S. aureus
enterotoxin A (SEQ ID NO:226); E. coli enterotoxin A (SEQ ID NO:227); C. difficile
enterotoxin A (SEQ ID NO:228); B. cereus enterotoxin A (SEQ ID NO:229);

pertussis toxin subunit 3 (SEQ ID NO:230)); SARS coronavirus (Frankfurt 1) envelope protein E (SEQ ID No:231); Human metapneumovirus fusion protein (SEQ ID NO:232); SARS coronavirus matrix protein (SEQ ID NO: 233); coronavirus nucleocapsid protein (SEQ ID NO: 234); and SARS coronavirus (Frankfurt 1) spike protein S (SEQ ID NO: 235).

50. The method of claim 41, wherein said OSPF-associated disorder is a viral infection due to a virus.

51. The method of claim 50, wherein said virus is selected from the group consisting of HIV, *e.g.*, HIV-1 and HIV-2, human herpes viruses, cytomegalovirus ((esp. Human), Rotavirus, Epstein-Barr virus, Varicella Zoster Virus, hepatitis viruses, such as hepatitis B virus, hepatitis A virus, hepatitis C virus and hepatitis E virus, paramyxoviruses: Respiratory Syncytial virus, parainfluenza virus, Ebola virus, measles virus, mumps virus, human papilloma viruses (for example HPV6, 11, 16, 18 and the like), flaviviruses (*e.g.* Yellow Fever Virus, Dengue Virus, Tick-borne encephalitis virus, Japanese Encephalitis Virus) or influenza virus.

52. The method of claim 51, wherein said virus is Ebola virus.

53. The method of claim 49, wherein said protein of interest is Ebola virus nucleoprotein (SEQ ID NO:210).

54. The method of claim 41, wherein said OSPF-associated disorder is a bacterial infection due to a bacteria.

55. The method of claim 54, wherein said bacteria is selected from the group consisting of *N. gonorrhea* and *N. meningitidis*, *Streptococcus* spp, including *S. pneumoniae*, *S. pyogenes*, *S. agalactiae*, *S. mutans*; *Haemophilus* spp, including *H. influenzae* type B, non typeable *H. influenzae*, *H. ducreyi*; *Moraxella* spp, including *M. catarrhalis*, also known as *Branhamella catarrhalis*; *Bordetella* spp, including *B. pertussis*, *B. parapertussis* and *B. bronchiseptica*; *Mycobacterium* spp., including *M. tuberculosis*, *M. bovis*, *M. leprae*, *M. avium*, *M. paratuberculosis*, *M. smegmatis*;

Legionella spp, including *L. pneumophila*; Escherichia spp, including enterotoxigenic *E. coli*, enterohemorrhagic *E. coli*, enteropathogenic *E. coli*; Vibrio spp, including *V. cholera*, Shigella spp, including *S. sonnei*, *S. dysenteriae*, *S. flexnerii*; Yersinia spp, including *Y. enterocolitica*, *Y. pestis*, *Y. pseudotuberculosis*, Campylobacter spp, including *C. jejuni* and *C. coli*; Salmonella spp, including *S. typhi*, *S. paratyphi*, *S. choleraesuis*, *S. enteritidis*; Listeria spp., including *L. monocytogenes*; Helicobacter spp, including *H. pylori*; Pseudomonas spp, including *P. aeruginosa*, Staphylococcus spp., including *S. aureus*, *S. epidermidis*; Enterococcus spp., including *E. faecalis*, *E. faecium*; Clostridium spp., including *C. tetani*, *C. botulinum*, *C. difficile*; Bacillus spp., including *B. anthracis*; Corynebacterium spp., including *C. diphtheriae*; Borrelia spp., including *B. burgdorferi*, *B. garinii*, *B. afzelii*, *B. andersonii*, *B. hermsii*; Ehrlichia spp., including *E. equi* and the agent of the Human Granulocytic Ehrlichiosis; Rickettsia spp, including *R. rickettsii*; Chlamydia spp., including *C. trachomatis*, *C. pneumoniae*, *C. psittaci*; Leptospira spp., including *L. interrogans*; Treponema spp., including *T. pallidum*, *T. denticola*, *T. hyodysenteriae*.

56. The method of claim 55, wherein said bacteria is *B. anthracis*.

57. The method of claim 49, wherein said protein of interest is anthrax toxins translocating protein (protective antigen precursor [PA]) (SEQ ID NO:209).

58. The method of claim 41, wherein said OSPF-associated disorder is a neoplastic disease.

59. The method of claim 58, wherein said neoplastic disease is selected from the group consisting of breast, colon, non-small cell lung, head and neck, colorectal, lung, prostate, ovary, renal, melanoma, gastrointestinal cancer and osteogenic sarcoma.

60. The method of claim 59, wherein said neoplastic disease is melanoma.

61. The method of claim 49, wherein said protein of interest is melanoma antigen p15 (SEQ ID NO:212).

62. The method of claim 41, wherein said OSPF-associated disorder is a state of toxicity due to a toxin.
63. The method of claim 62, wherein said toxin is selected from the group consisting of botulin, perfringens toxin, pertussis, mycotoxins, shigatoxins, staphylococcal enterotoxin B, tetanus, ricin, cholera, aflatoxins, diphtheria, T2, seguitoxin, saxitoxin, abrin, cyanoginosin, alphatoxin, tetrodotoxin, aconotoxin, snake venom, scorpion venom and spider venoms.
64. The method of claim 62, wherein said toxin is pertussis.
65. The method of claim 49, wherein said protein of interest is pertussis toxin subunit 3 (SEQ ID NO:230).
66. The method of claim 41, wherein said OSPF-associated disorder is a parasitic infection due to a parasite.
67. The method of claim 66, wherein said parasite is selected from the group consisting of Anaplasma, Babesia, Balantidium, Besnoitia, Chlamydia, Coccidia, Cryptosondium, Cytauxzoon, Eimeria Entamoeba, Eperythrozoon, Erlichia, Giardia, Haemobartonella, Hammondia, Isopora, Leishmania, Neorickettsia, Plasmodium, Pneumocystis, Rickettsia, Schistosoma, Sarcocystis, Theileria, Trichinella, Toxoplasma, Trichomonas, Trypanosoma, Unicaria, Dipylidium, Echinococcuse, Taenia, Ancylostoma, Ascaris, Enterobius, Strongyloides, Strongylus, Toxocara, Toxascaris and Trichuris.
68. The method of claim 67, wherein said parasite is Plasmodium.
69. The method of claim 49, wherein said protein of interest is circumsporozoite protein II (SEQ ID NO:224).

70. A method of treating an OSPF-associated disorder in a subject comprising administering to a subject an effective amount of an overlapping synthetic peptide
5 formulation (OSPF), wherein said OSPF comprises a combination of single chain peptides corresponding to an amino acid sequence of a protein of interest, wherein said single chain peptides are a length represented by Y, wherein Y is at least 7 to (X-1) and X is the number of amino acids of said protein of interest, wherein said length of said single chain peptides is such that internalization of said single chain peptide by
10 a MHC -bearing cell and presentation by a MHC molecule to a T cell is possible, such that said OSPF-associated disorder is treated in said subject.

71. The method of claim 70, wherein said subject is a vertebrate.

15 72. The method of claim 70, wherein said Y is fifteen (15) amino acids.

73. The method of claim 70, wherein said MHC-bearing cell is a MHC Class I-bearing cell.

20 74. The method of claim 73, wherein said MHC Class I-bearing cell is a CTL.

75. The method of claim 70, wherein said MHC-bearing cell is a MHC Class II-bearing cell.

25 76. The method of claim 75, wherein said MHC Class II-bearing cell is a B cell.

77. The method of claim 70, wherein said protein of interest is selected from the group consisting of HIV Gag (SEQ ID NO:339); SIV Envelope protein (SEQ ID NO:340); anthrax toxins translocating protein (protective antigen precursor [PA])
30 (SEQ ID NO:209); Ebola virus nucleoprotein (SEQ ID NO:210); hepatitis C virus (HCV) polyprotein (SEQ ID NO:211); melanoma antigen p15 (SEQ ID NO:212); human Her2/neu protein (SEQ ID NO:213); respiratory syncytial virus (RSV) fusion protein (SEQ ID NO:214); HIV-2 gp41 protein (SEQ ID NO:215); HIV-2 GAG

protein (SEQ ID NO:216); HIV-2 envelope (env) protein (SEQ ID NO:217); HIV-1 vpu protein (SEQ ID NO:218); HIV-1 envelope (env) protein (SEQ ID NO: 219); HIV-1 Tat interactive protein 2 (SEQ ID NO:220); HIV-1 reverse transcriptase (SEQ ID NO:221) and HIV-1 nef protein (SEQ ID NO:222); circumsporozoite protein
5 precursor (SEQ ID NO:223); circumsporozoite protein II (SEQ ID NO:224); pertussis-like toxin subunit (SEQ ID NO:225); *S. aureus* enterotoxin A (SEQ ID NO:226); *E. coli* enterotoxin A (SEQ ID NO:227); *C. difficile* enterotoxin A (SEQ ID NO:228); *B. cereus* enterotoxin A (SEQ ID NO:229); pertussis toxin subunit 3 (SEQ ID NO:230)); SARS coronavirus (Frankfurt 1) envelope protein E (SEQ ID No:231);
10 Human metapneumovirus fusion protein (SEQ ID NO:232); SARS coronavirus matrix protein (SEQ ID NO: 233); coronavirus nucleocapsid protein (SEQ ID NO: 234); and SARS coronavirus (Frankfurt 1) spike protein S (SEQ ID NO: 235).

78. The method of claim 70, wherein said OSPF-associated disorder is a viral
15 infection due to a virus.

79. The method of claim 78, wherein said virus is selected from the group consisting of HIV, *e.g.*, HIV-1 and HIV-2, human herpes viruses, cytomegalovirus (*esp.* Human), Rotavirus, Epstein-Barr virus, Varicella Zoster Virus, hepatitis viruses, such
20 as hepatitis B virus, hepatitis A virus, hepatitis C virus and hepatitis E virus, paramyxoviruses: Respiratory Syncytial virus, parainfluenza virus, Ebola virus, measles virus, mumps virus, human papilloma viruses (for example HPV6, 11, 16, 18 and the like), flaviviruses (*e.g.* Yellow Fever Virus, Dengue Virus, Tick-borne encephalitis virus, Japanese Encephalitis Virus) or influenza virus.

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80. The method of claim 79, wherein said virus is Ebola virus.

81. The method of claim 77, wherein said protein of interest is Ebola virus nucleoprotein (SEQ ID NO:210).

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82. The method of claim 70, wherein said OSPF-associated disorder is a bacterial infection due to a bacteria.

83. The method of claim 82, wherein said bacteria is selected from the group consisting of *N. gonorrhea* and *N. meningitidis*, *Streptococcus* spp, including *S. pneumoniae*, *S. pyogenes*, *S. agalactiae*, *S. mutans*; *Haemophilus* spp, including *H. influenzae* type B, non typeable *H. influenzae*, *H. ducreyi*; *Moraxella* spp, including
5 *M. catarrhalis*, also known as *Branhamella catarrhalis*; *Bordetella* spp, including *B. pertussis*, *B. parapertussis* and *B. bronchiseptica*; *Mycobacterium* spp., including *M. tuberculosis*, *M. bovis*, *M. leprae*, *M. avium*, *M. paratuberculosis*, *M. smegmatis*; *Legionella* spp, including *L. pneumophila*; *Escherichia* spp, including enterotoxigenic *E. coli*, enterohemorrhagic *E. coli*, enteropathogenic *E. coli*; *Vibrio* spp, including *V.*
10 *cholera*, *Shigella* spp, including *S. sonnei*, *S. dysenteriae*, *S. flexnerii*; *Yersinia* spp, including *Y. enterocolitica*, *Y. pestis*, *Y. pseudotuberculosis*, *Campylobacter* spp, including *C. jejuni* and *C. coli*; *Salmonella* spp, including *S. typhi*, *S. paratyphi*, *S. choleraesuis*, *S. enteritidis*; *Listeria* spp., including *L. monocytogenes*; *Helicobacter* spp, including *H. pylori*; *Pseudomonas* spp, including *P. aeruginosa*, *Staphylococcus* spp., including *S. aureus*, *S. epidermidis*; *Enterococcus* spp., including *E. faecalis*, *E. faecium*; *Clostridium* spp., including *C. tetani*, *C. botulinum*, *C. difficile*; *Bacillus* spp., including *B. anthracis*; *Corynebacterium* spp., including *C. diphtheriae*; *Borrelia* spp., including *B. burgdorferi*, *B. garinii*, *B. afzelii*, *B. andersonii*, *B. hermsii*; *Ehrlichia* spp., including *E. equi* and the agent of the Human Granulocytic
15 Ehrlichiosis; *Rickettsia* spp, including *R. rickettsii*; *Chlamydia* spp., including *C. trachomatis*, *C. pneumoniae*, *C. psittaci*; *Leptospira* spp., including *L. interrogans*; *Treponema* spp., including *T. pallidum*, *T. denticola*, *T. hyodysenteriae*.

84. The method of claim 83, wherein said bacteria is *B. anthracis*.

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85. The method of claim 77, wherein said protein of interest is anthrax toxins translocating protein (protective antigen precursor [PA]) (SEQ ID NO:209).

86. The method of claim 70, wherein said OSPF-associated disorder is a neoplastic
30 disease.

87. The method of claim 86, wherein said neoplastic disease is selected from the group consisting of breast, colon, non-small cell lung, head and neck, colorectal, lung, prostate, ovary, renal, melanoma, gastrointestinal cancer and osteogenic sarcoma.
- 5 88. The method of claim 87, wherein said neoplastic disease is melanoma.
89. The method of claim 77, wherein said protein of interest melanoma antigen p15 (SEQ ID NO:212).
- 10 90. The method of claim 70, wherein said OSPF-associated disorder is a state of toxicity due to a toxin.
91. The method of claim 90, wherein said toxin is selected from the group consisting of botulin, perfringens toxin, pertussis, mycotoxins, shigatoxins, staphylococcal enterotoxin B, tetanus, ricin, cholera, aflatoxins, diphtheria, T2, seguitoxin, saxitoxin, abrin, cyanoginosin, alphatoxin, tetrodotoxin, aconotoxin, snake venom, scorpion venom and spider venoms.
- 15 92. The method of claim 91, wherein said toxin is pertussis.
- 20 93. The method of claim 77, wherein said protein of interest is pertussis toxin subunit 3 (SEQ ID NO:230).
94. The method of claim 70, wherein said OSPF-associated disorder is a parasitic infection due to a parasite.
- 25 95. The method of claim 94, wherein said parasite is selected from the group consisting of Anaplasma, Babesia, Balantidium, Besnoitia, Chlamydia, Coccidia, Cryptosporidium, Cytauxzoon, Eimeria Entamoeba, Eperythrozoon, Erlichia, Giardia, Haemobartonella, Hammondia, Isopora, Leishmania, Neorickettsia, Plasmodium, Pneumocystis, Rickettsia, Schistosoma, Sarcocystis, Theileria, Trichinella, Toxoplasma, Trichomonas, Trypanosoma, Unicaria, Dipylidium, Echinococcuse,
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Taenia, Ancylostoma, Ascaris, Enterobius, Strongyloides, Strongylus, Toxocara, Toxascaris and Trichuris.

96. The method of claim 95, wherein said parasite is Plasmodium.

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97. The method of claim 77, wherein said protein of interest is circumsporozoite protein II (SEQ ID NO:224).

98. A vaccine for immunizing a subject against an OSPF-associated disorder by
10 modulating a CTL-mediated immune response comprising a pharmaceutically
acceptable carrier and an overlapping synthetic peptide formulation (OSPF), wherein
said OSPF comprises a combination of single chain peptides corresponding to an
amino acid sequence of a protein of interest, wherein said single chain peptide is a
length represented by Y, wherein Y at least 7 to (X-1) and X is the number of amino
15 acids of said protein of interest, and wherein at least one single chain peptide overlaps
with another single chain peptide by a length represented by Z, wherein Z is 1 to (Y-
1), wherein said length of said single chain peptide is such that internalization of said
single chain peptide by a MHC-bearing cell and presentation by a MHC molecule to a
T cell is possible.

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99. The vaccine of claim 98, wherein said subject is a vertebrate.

100. The vaccine of claim 98, wherein said Y is fifteen (15) amino acids.

25 101. The vaccine of claim 98, wherein said Z is five (5) amino acids.

102. The vaccine of claim 98, wherein said MHC-bearing cell is a MHC Class I-
bearing cell.

30 103. The vaccine of claim 102, wherein said MHC Class I-bearing cell is a CTL.

104. The vaccine of claim 98, wherein said MHC-bearing cell is a MHC Class II-
bearing cell.

105. The vaccine of claim 104, wherein said MHC Class II-bearing cell is a B cell.

106. The vaccine of claim 98, wherein said protein of interest is selected from the
 5 group consisting of HIV Gag protein (SEQ ID NO:339); SIV Envelope protein (SEQ
 ID NO:340); anthrax toxins translocating protein (protective antigen precursor [PA])
 (SEQ ID NO:209); Ebola virus nucleoprotein (SEQ ID NO:210); hepatitis C virus
 (HCV) polyprotein (SEQ ID NO:211); melanoma antigen p15 (SEQ ID NO:212);
 human Her2/neu protein (SEQ ID NO:213); respiratory syncytial virus (RSV) fusion
 10 protein (SEQ ID NO:214); HIV-2 gp41 protein (SEQ ID NO:215); HIV-2 GAG
 protein (SEQ ID NO:216); HIV-2 envelope (env) protein (SEQ ID NO:217); HIV-1
 vpu protein (SEQ ID NO:218); HIV-1 envelope (env) protein (SEQ ID NO: 219);
 HIV-1 Tat interactive protein 2 (SEQ ID NO:220); HIV-1 reverse transcriptase (SEQ
 ID NO:221) and HIV-1 nef protein (SEQ ID NO:222); circumsporozoite protein
 15 precursor (SEQ ID NO:223); circumsporozoite protein II (SEQ ID NO:224);
 pertussis-like toxin subunit (SEQ ID NO:225); *S. aureus* enterotoxin A (SEQ ID
 NO:226); *E. coli* enterotoxin A (SEQ ID NO:227); *C. difficile* enterotoxin A (SEQ ID
 NO:228); *B. cereus* enterotoxin A (SEQ ID NO:229); pertussis toxin subunit 3 (SEQ
 ID NO:230)); SARS coronavirus (Frankfurt 1) envelope protein E (SEQ ID No:231);
 20 Human metapneumovirus fusion protein (SEQ ID NO:232); SARS coronavirus
 matrix protein (SEQ ID NO: 233); coronavirus nucleocapsid protein (SEQ ID NO:
 234); and SARS coronavirus (Frankfurt 1) spike protein S (SEQ ID NO: 235).

25 107. The vaccine of claim 98, wherein said OSPF-associated disorder is a viral
 infection due to a virus.

108. The vaccine of claim 107, wherein said virus is selected from the group
 consisting of HIV, *e.g.*, HIV-1 AND HIV-2, human herpes viruses, cytomegalovirus
 30 (esp. Human), Rotavirus, Epstein-Barr virus, Varicella Zoster Virus, hepatitis viruses,
 such as hepatitis B virus, hepatitis A virus, hepatitis C virus and hepatitis E virus,
 paramyxoviruses: Respiratory Syncytial virus, parainfluenza virus, Ebola virus,
 measles virus, mumps virus, human papilloma viruses (for example HPV6, 11, 16, 18

and the like), flaviviruses (*e.g.* Yellow Fever Virus, Dengue Virus, Tick-borne encephalitis virus, Japanese Encephalitis Virus) or influenza virus..

109. The vaccine of claim 108, wherein said virus is Ebola virus.

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110. The vaccine of claim 105, wherein said protein of interest is Ebola virus nucleoprotein (SEQ ID NO:210).

111. The vaccine of claim 98, wherein said OSPF-associated disorder is a bacterial
10 infection due to a bacteria.

112. The vaccine of claim 111, wherein said bacteria is selected from the group consisting of *N. gonorrhea* and *N. meningitidis*, *Streptococcus* spp, including *S. pneumoniae*, *S. pyogenes*, *S. agalactiae*, *S. mutans*; *Haemophilus* spp, including *H. influenzae* type B, non typeable *H. influenzae*, *H. ducreyi*; *Moraxella* spp, including *M. catarrhalis*, also known as *Branhamella catarrhalis*; *Bordetella* spp, including *B. pertussis*, *B. parapertussis* and *B. bronchiseptica*; *Mycobacterium* spp., including *M. tuberculosis*, *M. bovis*, *M. leprae*, *M. avium*, *M. paratuberculosis*, *M. smegmatis*; *Legionella* spp, including *L. pneumophila*; *Escherichia* spp, including enterotoxigenic *E. coli*, enterohemorrhagic *E. coli*, enteropathogenic *E. coli*; *Vibrio* spp, including *V. cholera*, *Shigella* spp, including *S. sonnei*, *S. dysenteriae*, *S. flexnerii*; *Yersinia* spp, including *Y. enterocolitica*, *Y. pestis*, *Y. pseudotuberculosis*, *Campylobacter* spp, including *C. jejuni* and *C. coli*; *Salmonella* spp, including *S. typhi*, *S. paratyphi*, *S. choleraesuis*, *S. enteritidis*; *Listeria* spp., including *L. monocytogenes*; *Helicobacter*
20 spp, including *H. pylori*; *Pseudomonas* spp, including *P. aeruginosa*, *Staphylococcus* spp., including *S. aureus*, *S. epidermidis*; *Enterococcus* spp., including *E. faecalis*, *E. faecium*; *Clostridium* spp., including *C. tetani*, *C. botulinum*, *C. difficile*; *Bacillus* spp., including *B. anthracis*; *Corynebacterium* spp., including *C. diphtheriae*; *Borrelia* spp., including *B. burgdorferi*, *B. garinii*, *B. afzelii*, *B. andersonii*, *B. hermsii*;
25 *Ehrlichia* spp., including *E. equi* and the agent of the Human Granulocytic Ehrlichiosis; *Rickettsia* spp, including *R. rickettsii*; *Chlamydia* spp., including *C. trachomatis*, *C. pneumoniae*, *C. psittaci*; *Leptira* spp., including *L. interrogans*; *Treponema* spp., including *T. pallidum*, *T. denticola*, *T. hyodysenteriae*.

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113. The vaccine of claim 112, wherein said bacteria is *B. anthracis*.
114. The vaccine of claim 105, wherein said protein of interest is anthrax toxins
5 translocating protein (protective antigen precursor [PA]) (SEQ ID NO:209).
115. The vaccine of claim 98, wherein said OSPF-associated disorder is a neoplastic disease.
- 10 116. The vaccine of claim 115, wherein said neoplastic disease is selected from the group consisting of breast, colon, non-small cell lung, head and neck, colorectal, lung, prostate, ovary, renal, melanoma, gastrointestinal cancer and osteogenic sarcoma.
- 15 117. The vaccine of claim 116, wherein said neoplastic disease is melanoma.
118. The vaccine of claim 117, wherein said protein of interest is melanoma antigen p15 (SEQ ID NO:212).
- 20 119. The vaccine of claim 98, wherein said OSPF-associated disorder is a state of toxicity due to a toxin.
120. The vaccine of claim 119, wherein said toxin is selected from the group consisting of botulin, perfringens toxin, pertussis, mycotoxins, shigatoxins,
25 staphylococcal enterotoxin B, tetanus, ricin, cholera, aflatoxins, diphtheria, T2, seguitoxin, saxitoxin, abrin, cyanoginosin, alphatoxin, tetrodotoxin, aconotoxin, snake venom, scorpion venom and spider venoms.
121. The vaccine of claim 120, wherein said toxin is pertussis.
- 30 122. The vaccine of claim 106, wherein said protein of interest is pertussis toxin subunit 3 (SEQ ID NO:230).

123. The method of claim 98, wherein said OSPF-associated disorder is a parasitic infection due to a parasite.

124. The method of claim 123, wherein said parasite is selected from the group
5 consisting of Anaplasma, Babesia, Balantidium, Besnoitia, Chlamydia, Coccidia, Cryptosporidium, Cytauxzoon, Eimeria Entamoeba, Eperythrozoon, Erlichia, Giardia, Haemobartonella, Hammondia, Isopora, Leishmania, Neorickettsia, Plasmodium, Pneumocystis, Rickettsia, Schistosoma, Sarcocystis, Theileria, Trichinella, Toxoplasma, Trichomonas, Trypanosoma, Uncaria, Dipylidium, Echinococcus,
10 Taenia, Ancylostoma, Ascaris, Enterobius, Strongyloides, Strongylus, Toxocara, Toxascaris and Trichuris..

125. The method of claim 124, wherein said parasite is Plasmodium.

15 126. The method of claim 106, wherein said protein of interest is circumsporozoite protein II (SEQ ID NO:224).

127. A vaccine for immunizing a subject against an OSPF-associated disorder comprising a pharmaceutically acceptable carrier and an overlapping synthetic
20 peptide formulation (OSPF), wherein said OSPF comprises a combination of single chain peptides corresponding to an amino acid sequence of a protein of interest, wherein said single chain peptides are a length represented by Y, wherein Y at least 7 to (X-1) and X is the number of amino acids of said protein of interest, wherein said length of said single chain peptides is such that internalization of said single chain
25 peptide by a MHC -bearing cell and presentation by a MHC molecule to a T cell is possible.

128. The vaccine of claim 127, wherein said subject is a vertebrate.

30 129. The vaccine of claim 127, wherein said Y is fifteen (15) amino acids.

130. The vaccine of claim 127, wherein said MHC-bearing cell is a MHC Class I-bearing cell.

131. The vaccine of claim 130, wherein said MHC Class I-bearing cell is a CTL.

132. The vaccine of claim 127, wherein said MHC-bearing cell is a MHC Class II-
5 bearing cell.

133. The vaccine of claim 132, wherein said MHC Class II-bearing cell is a B cell.

134. The vaccine of claim 127, wherein said protein of interest is selected from the
10 group consisting of HIV Gag protein (SEQ ID NO:339); SIV Envelope protein (SEQ
ID NO:340); anthrax toxins translocating protein (protective antigen precursor [PA])
(SEQ ID NO:209); Ebola virus nucleoprotein (SEQ ID NO:210); hepatitis C virus
(HCV) polyprotein (SEQ ID NO:211); melanoma antigen p15 (SEQ ID NO:212);
human Her2/neu protein (SEQ ID NO:213); respiratory syncytial virus (RSV) fusion
15 protein (SEQ ID NO:214); HIV-2 gp41 protein (SEQ ID NO:215); HIV-2 GAG
protein (SEQ ID NO:216); HIV-2 envelope (env) protein (SEQ ID NO:217); HIV-1
vpu protein (SEQ ID NO:218); HIV-1 envelope (env) protein (SEQ ID NO: 219);
HIV-1 Tat interactive protein 2 (SEQ ID NO:220); HIV-1 reverse transcriptase (SEQ
ID NO:221) and HIV-1 nef protein (SEQ ID NO:222); circumsporozoite protein
20 precursor (SEQ ID NO:223); circumsporozoite protein II (SEQ ID NO:224);
pertussis-like toxin subunit (SEQ ID NO:225); S. aureus enterotoxin A (SEQ ID
NO:226); E. coli enterotoxin A (SEQ ID NO:227); C. difficile enterotoxin A (SEQ ID
NO:228); B. cereus enterotoxin A (SEQ ID NO:229); pertussis toxin subunit 3 (SEQ
ID NO:230)); SARS coronavirus (Frankfurt 1) envelope protein E (SEQ ID No:231);
25 Human metapneumovirus fusion protein (SEQ ID NO:232); SARS coronavirus
matrix protein (SEQ ID NO: 233); coronavirus nucleocapsid protein (SEQ ID NO:
234); and SARS coronavirus (Frankfurt 1) spike protein S (SEQ ID NO: 235).

135. The vaccine of claim 127, wherein said OSPF-associated disorder is a viral
30 infection due to a virus.

136. The vaccine of claim 135, wherein said virus is selected from the group
consisting of , HIV, *e.g.*, HIV-1 and HIV-2, human herpes viruses, cytomegalovirus

(esp. Human), Rotavirus, Epstein-Barr virus, Varicella Zoster Virus, hepatitis viruses, such as hepatitis B virus, hepatitis A virus, hepatitis C virus and hepatitis E virus, paramyxoviruses: Respiratory Syncytial virus, parainfluenza virus, Ebola virus, measles virus, mumps virus, human papilloma viruses (for example HPV6, 11, 16, 18
 5 and the like), flaviviruses (e.g. Yellow Fever Virus, Dengue Virus, Tick-borne encephalitis virus, Japanese Encephalitis Virus) or influenza virus..

137. The vaccine of claim 136, wherein said virus is Ebola virus.

10 138. The vaccine of claim 134, wherein said protein of interest is Ebola virus nucleoprotein (SEQ ID NO:210).

139. The vaccine of claim 127, wherein said OSPF-associated disorder is a bacterial infection due to a bacteria.

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140. The vaccine of claim 139, wherein said bacteria is selected from the group consisting of *N. gonorrhea* and *N. meningitidis*, *Streptococcus* spp, including *S. pneumoniae*, *S. pyogenes*, *S. agalactiae*, *S. mutans*; *Haemophilus* spp, including *H. influenzae* type B, non typeable *H. influenzae*, *H. ducreyi*; *Moraxella* spp, including
 20 *M. catarrhalis*, also known as *Branhamella catarrhalis*; *Bordetella* spp, including *B. pertussis*, *B. parapertussis* and *B. bronchiseptica*; *Mycobacterium* spp., including *M. tuberculosis*, *M. bovis*, *M. leprae*, *M. avium*, *M. paratuberculosis*, *M. smegmatis*; *Legionella* spp, including *L. pneumophila*; *Escherichia* spp, including enterotoxigenic *E. coli*, enterohemorrhagic *E. coli*, enteropathogenic *E. coli*; *Vibrio* spp, including *V.*
 25 *cholera*, *Shigella* spp, including *S. sonnei*, *S. dysenteriae*, *S. flexnerii*; *Yersinia* spp, including *Y. enterocolitica*, *Y. pestis*, *Y. pseudotuberculosis*, *Campylobacter* spp, including *C. jejuni* and *C. coli*; *Salmonella* spp, including *S. typhi*, *S. paratyphi*, *S. choleraesuis*, *S. enteritidis*; *Listeria* spp., including *L. monocytogenes*; *Helicobacter* spp, including *H. pylori*; *Pseudomonas* spp, including *P. aeruginosa*, *Staphylococcus*
 30 spp., including *S. aureus*, *S. epidermidis*; *Enterococcus* spp., including *E. faecalis*, *E. faecium*; *Clostridium* spp., including *C. tetani*, *C. botulinum*, *C. difficile*; *Bacillus* spp., including *B. anthracis*; *Corynebacterium* spp., including *C. diphtheriae*; *Borrelia* spp., including *B. burgdorferi*, *B. garinii*, *B. afzelii*, *B. andersonii*, *B. hermsii*;

Ehrlichia spp., including *E. equi* and the agent of the Human Granulocytic Ehrlichiosis; *Rickettsia* spp, including *R. rickettsii*; *Chlamydia* spp., including *C. trachomatis*, *C. pneumoniae*, *C. psittaci*; *Leptira* spp., including *L. interrogans*; *Treponema* spp., including *T. pallidum*, *T. denticola*, *T. hyodysenteriae*.

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141. The vaccine of claim 140, wherein said bacteria is *B. anthracis*.

142. The vaccine of claim 134, wherein said protein of interest is anthrax toxins translocating protein (protective antigen precursor [PA]) (SEQ ID NO:209).

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143. The vaccine of claim 127, wherein said OSPF-associated disorder is a neoplastic disease.

144. The vaccine of claim 142, wherein said neoplastic disease is selected from the group consisting of breast, colon, non-small cell lung, head and neck, colorectal, lung, prostate, ovary, renal, melanoma, gastrointestinal cancer and osteogenic sarcoma.

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145. The vaccine of claim 144, wherein said neoplastic disease is melanoma.

146. The vaccine of claim 134, wherein said protein of interest is melanoma antigen p15 (SEQ ID NO:212).

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147. The vaccine of claim 127, wherein said OSPF-associated disorder is a state of toxicity due to a toxin.

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148. The vaccine of claim 147, wherein said toxin is selected from the group consisting of botulin, perfringens toxin, pertussis, mycotoxins, shigatoxins, staphylococcal enterotoxin B, tetanus, ricin, cholera, aflatoxins, diphtheria, T2, seguitoxin, saxitoxin, abrin, cyanoginosin, alphatoxin, tetrodotoxin, aconotoxin, snake venom, scorpion venom and spider venoms.

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149. The vaccine of claim 148, wherein said toxin is pertussis.

150. The vaccine of claim 134, wherein said protein of interest is pertussis toxin subunit 3 (SEQ ID NO:230).

151. The method of claim 127, wherein said OSPF-associated disorder is a parasitic
5 infection due to a parasite.

152. The method of claim 151, wherein said parasite is selected from the group consisting of Anaplasma, Babesia, Balantidium, Besnoitia, Chlamydia, Coccidia, Cryptosporidium, Cytauxzoon, Eimeria, Entamoeba, Eperythrozoon, Erlichia, Giardia,
10 Haemobartonella, Hammondia, Isopora, Leishmania, Neorickettsia, Plasmodium, Pneumocystis, Rickettsia, Schistosoma, Sarcocystis, Theileria, Trichinella, Toxoplasma, Trichomonas, Trypanosoma, Uncaria, Dipylidium, Echinococcus, Taenia, Ancylostoma, Ascaris, Enterobius, Strongyloides, Strongylus, Toxocara, Toxascaris and Trichuris.

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153. The vaccine of claim 152, wherein said parasite is Plasmodium.

154. The method of claim 134, wherein said protein of interest is circumsporozoite protein II (SEQ ID NO:224).

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155. A kit for immunizing a subject against an OSPF-associated disorder comprising the vaccine of any one of claims 98 or 127 and instructions for use.

156. A method of preventing an OSPF-associated disorder in a subject comprising
25 administering to a subject an effective amount of an overlapping synthetic peptide formulation (OSPF), wherein said OSPF comprises a combination of single chain peptides corresponding to an amino acid sequence of a protein of interest, wherein said single chain peptide is a length represented by Y, wherein Y is at least 7 to (X-1) and X is the number of amino acids of said protein of interest, and wherein at least
30 one single chain peptide overlaps with another single chain peptide by a length of Z, wherein Z is 1 to (Y-1), wherein said length of said single chain peptide is such that internalization of said single chain peptide by a MHC-bearing cell and presentation by

a MHC molecule to a T cell is possible, such that said OSPF-associated disorder is prevented in said subject.

157. The method of claim 156, wherein said subject is a vertebrate.

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158. The method of claim 156, wherein said Y is fifteen (15) amino acids.

159. The method of claim 156, wherein said Z is five (5) amino acids.

10 160. The method of claim 156, wherein said MHC-bearing cell is a MHC Class I-bearing cell.

161. The method of claim 160, wherein said MHC Class I-bearing cell is a CTL.

15 162. The method of claim 156, wherein said MHC-bearing cell is a MHC Class II-bearing cell.

163. The method of claim 162, wherein said MHC Class II-bearing cell is a B cell.

20 164. The method of claim 156, wherein said protein of interest is selected from the group consisting of HIV Gag protein (SEQ ID NO:339); SIV Envelope protein (SEQ ID NO:340); anthrax toxins translocating protein (protective antigen precursor [PA]) (SEQ ID NO:209); Ebola virus nucleoprotein (SEQ ID NO:210); hepatitis C virus (HCV) polyprotein (SEQ ID NO:211); melanoma antigen p15 (SEQ ID NO:212);
25 human Her2/neu protein (SEQ ID NO:213); respiratory syncytial virus (RSV) fusion protein (SEQ ID NO:214); HIV-2 gp41 protein (SEQ ID NO:215); HIV-2 GAG protein (SEQ ID NO:216); HIV-2 envelope (env) protein (SEQ ID NO:217); HIV-1 vpu protein (SEQ ID NO:218); HIV-1 envelope (env) protein (SEQ ID NO: 219); HIV-1 Tat interactive protein 2 (SEQ ID NO:220); HIV-1 reverse transcriptase (SEQ
30 ID NO:221) and HIV-1 nef protein (SEQ ID NO:222); circumsporozoite protein precursor (SEQ ID NO:223); circumsporozoite protein II (SEQ ID NO:224); pertussis-like toxin subunit (SEQ ID NO:225); S. aureus enterotoxin A (SEQ ID NO:226); E. coli enterotoxin A (SEQ ID NO:227); C. difficile enterotoxin A (SEQ ID

NO:228); *B. cereus* enterotoxin A (SEQ ID NO:229); pertussis toxin subunit 3 (SEQ ID NO:230)); SARS coronavirus (Frankfurt 1) envelope protein E (SEQ ID No:231); Human metapneumovirus fusion protein (SEQ ID NO:232); SARS coronavirus matrix protein (SEQ ID NO: 233); coronavirus nucleocapsid protein (SEQ ID NO: 5 234); and SARS coronavirus (Frankfurt 1) spike protein S (SEQ ID NO: 235).

165. The method of claim 156, wherein said OSPF-associated disorder is a viral infection due to a virus.

10 166. The method of claim 165, wherein said virus is selected from the group consisting of HIV, *e.g.*, HIV-1 and HIV-2, human herpes viruses, cytomegalovirus (esp Human), Rotavirus, Epstein-Barr virus, Varicella Zoster Virus, hepatitis viruses, such as hepatitis B virus, hepatitis A virus, hepatitis C virus and hepatitis E virus, paramyxoviruses: Respiratory Syncytial virus, parainfluenza virus, Ebola virus, 15 measles virus, mumps virus, human papilloma viruses (for example HPV6, 11, 16, 18 and the like), flaviviruses (*e.g.* Yellow Fever Virus, Dengue Virus, Tick-borne encephalitis virus, Japanese Encephalitis Virus) or influenza virus..

167. The method of claim 166, wherein said virus is Ebola virus.

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168. The method of claim 164, wherein said protein of interest is Ebola virus nucleoprotein (SEQ ID NO:210).

169. The method of claim 156, wherein said OSPF-associated disorder is a bacterial 25 infection due to a bacteria.

170. The method of claim 169, wherein said bacteria is selected from the group consisting of *N. gonorrhea* and *N. meningitidis*, *Streptococcus* spp, including *S. pneumoniae*, *S. pyogenes*, *S. agalactiae*, *S. mutans*; *Haemophilus* spp, including *H. influenzae* type B, non typeable *H. influenzae*, *H. ducreyi*; *Moraxella* spp, including *M. catarrhalis*, also known as *Branhamella catarrhalis*; *Bordetella* spp, including *B. pertussis*, *B. parapertussis* and *B. bronchiseptica*; *Mycobacterium* spp., including *M. tuberculosis*, *M. bovis*, *M. leprae*, *M. avium*, *M. paratuberculosis*, *M. smegmatis*; 30

Legionella spp, including *L. pneumophila*; Escherichia spp, including enterotoxigenic *E. coli*, enterohemorrhagic *E. coli*, enteropathogenic *E. coli*; Vibrio spp, including *V. cholera*, Shigella spp, including *S. sonnei*, *S. dysenteriae*, *S. flexnerii*; Yersinia spp, including *Y. enterocolitica*, *Y. pestis*, *Y. pseudotuberculosis*, Campylobacter spp, including *C. jejuni* and *C. coli*; Salmonella spp, including *S. typhi*, *S. paratyphi*, *S. choleraesuis*, *S. enteritidis*; Listeria spp., including *L. monocytogenes*; Helicobacter spp, including *H. pylori*; Pseudomonas spp, including *P. aeruginosa*, Staphylococcus spp., including *S. aureus*, *S. epidermidis*; Enterococcus spp., including *E. faecalis*, *E. faecium*; Clostridium spp., including *C. tetani*, *C. botulinum*, *C. difficile*; Bacillus spp., including *B. anthracis*; Corynebacterium spp., including *C. diphtheriae*; Borrelia spp., including *B. burgdorferi*, *B. garinii*, *B. afzelii*, *B. andersonii*, *B. hermsii*; Ehrlichia spp., including *E. equi* and the agent of the Human Granulocytic Ehrlichiosis; Rickettsia spp, including *R. rickettsii*; Chlamydia spp., including *C. trachomatis*, *C. pneumoniae*, *C. psittaci*; Leptospira spp., including *L. interrogans*; Treponema spp., including *T. pallidum*, *T. denticola*, *T. hyodysenteriae*.

171. The method of claim 170, wherein said bacteria is *B. anthracis*.

172. The method of claim 164, wherein said protein of interest is anthrax toxins translocating protein (protective antigen precursor [PA]) (SEQ ID NO:209).

173. The method of claim 156, wherein said OSPF-associated disorder is a neoplastic disease.

174. The method of claim 173, wherein said neoplastic disease is selected from the group consisting of breast, colon, non-small cell lung, head and neck, colorectal, lung, prostate, ovary, renal, melanoma, gastrointestinal cancer and osteogenic sarcoma.

175. The method of claim 174, wherein said neoplastic disease is melanoma.

176. The method of claim 164, wherein said protein of interest is melanoma antigen p15 (SEQ ID NO:212);

177. The method of claim 156, wherein said OSPF-associated disorder is a state of toxicity due to a toxin.

178. The method of claim 177, wherein said toxin is selected from the group consisting of botulin, perfringens toxin, pertussis, mycotoxins, shigatoxins, staphylococcal enterotoxin B, tetanus, ricin, cholera, aflatoxins, diphtheria, T2, seguitoxin, saxitoxin, abrin, cyanoginosin, alphatoxin, tetrodotoxin, aconotoxin, snake venom, scorpion venom and spider venoms.

179. The method of claim 178, wherein said toxin is pertussis.

180. The method of claim 164, wherein said protein of interest is pertussis toxin subunit 3 (SEQ ID NO:230).

181. The method of claim 156, wherein said OSPF-associated disorder is a parasitic infection due to a parasite.

182. The method of claim 181, wherein said parasite is selected from the group consisting of Anaplasma, Babesia, Balantidium, Besnoitia, Chlamydia, Coccidia, Cryptospondium, Cytauxzoon, Eimeria Entamoeba, Eperythrozoon, Erlichia, Giardia, Haemobartonella, Hammondia, Isopora, Leishmania, Neorickettsia, Plasmodium, Pneumocystis, Rickettsia, Schistosoma, Sarcocystis, Theileria, Trichinella, Toxoplasma, Trichomonas, Trypanosoma, Uncaria, Dipylidium, Echinococcuse, Taenia, Ancylostoma, Ascaris, Enterobius, Strongyloides, Strongylus, Toxocara, Toxascaris and Trichuris.

183. The method of claim 182, wherein said parasite is Plasmodium.

184. The method of claim 164, wherein said protein of interest is circumsporozoite protein II (SEQ ID NO:224).

185. A method of preventing an OSPF-associated disorder in a subject comprising administering to a subject an effective amount of an overlapping synthetic peptide

formulation (OSPF), wherein said OSPF comprises a combination of single chain peptides corresponding to an amino acid sequence of a protein of interest, wherein said single chain peptides are a length represented by Y, wherein Y is at least 7 to (X-1) and X is the number of amino acids of said protein of interest, wherein said length
5 of said single chain peptides is such that internalization of said single chain peptide by a MHC -bearing cell and presentation by a MHC molecule to a T cell is possible, such that said OSPF-associated disorder is prevented in said subject.

10 186. The method of claim 185, wherein said subject is a vertebrate.

187. The method of claim 185, wherein said Y is fifteen (15) amino acids.

188. The method of claim 185, wherein said MHC-bearing cell is a MHC Class I-bearing cell.

15 189. The method of claim 188, wherein said MHC Class I-bearing cell is a CTL.

190. The method of claim 185, wherein said MHC-bearing cell is a MHC Class II-bearing cell.

20 191. The method of claim 190, wherein said MHC Class II-bearing cell is a B cell.

192. The method of claim 185, wherein said protein of interest is selected from the group consisting of HIV Gag protein (SEQ ID NO:339); SIV Envelope protein (SEQ
25 ID NO:340); anthrax toxins translocating protein (protective antigen precursor [PA]) (SEQ ID NO:209); Ebola virus nucleoprotein (SEQ ID NO:210); hepatitis C virus (HCV) polyprotein (SEQ ID NO:211); melanoma antigen p15 (SEQ ID NO:212); human Her2/neu protein (SEQ ID NO:213); respiratory syncytial virus (RSV) fusion protein (SEQ ID NO:214); HIV-2 gp41 protein (SEQ ID NO:215); HIV-2 GAG
30 protein (SEQ ID NO:216); HIV-2 envelope (env) protein (SEQ ID NO:217); HIV-1 vpu protein (SEQ ID NO:218); HIV-1 envelope (env) protein (SEQ ID NO: 219); HIV-1 Tat interactive protein 2 (SEQ ID NO:220); HIV-1 reverse transcriptase (SEQ ID NO:221) and HIV-1 nef protein (SEQ ID NO:222); circumsporozoite protein

precursor (SEQ ID NO:223); circumsporozoite protein II (SEQ ID NO:224); pertussis-like toxin subunit (SEQ ID NO:225); *S. aureus* enterotoxin A (SEQ ID NO:226); *E. coli* enterotoxin A (SEQ ID NO:227); *C. difficile* enterotoxin A (SEQ ID NO:228); *B. cereus* enterotoxin A (SEQ ID NO:229); pertussis toxin subunit 3 (SEQ ID NO:230)); SARS coronavirus (Frankfurt 1) envelope protein E (SEQ ID No:231); Human metapneumovirus fusion protein (SEQ ID NO:232); SARS coronavirus matrix protein (SEQ ID NO: 233); coronavirus nucleocapsid protein (SEQ ID NO: 234); and SARS coronavirus (Frankfurt 1) spike protein S (SEQ ID NO: 235).

10 193. The method of claim 185, wherein said OSPF-associated disorder is a viral infection due to a virus.

194. The method of claim 193, wherein said virus is selected from the group consisting of HIV, *e.g.*, HIV-1 and HIV-2, human herpes viruses, cytomegalovirus ((esp Human), Rotavirus, Epstein-Barr virus, Varicella Zoster Virus, hepatitis viruses, such as hepatitis B virus, hepatitis A virus, hepatitis C virus and hepatitis E virus, paramyxoviruses: Respiratory Syncytial virus, parainfluenza virus, Ebola virus, measles virus, mumps virus, human papilloma viruses (for example HPV6, 11, 16, 18 and the like), flaviviruses (*e.g.* Yellow Fever Virus, Dengue Virus, Tick-borne encephalitis virus, Japanese Encephalitis Virus) or influenza virus.

195. The method of claim 194, wherein said virus is Ebola virus.

196. The method of claim 192, wherein said protein of interest is Ebola virus nucleoprotein (SEQ ID NO:210).

197. The method of claim 185, wherein said OSPF-associated disorder is a bacterial infection due to a bacteria.

30 198. The method of claim 197, wherein said bacteria is selected from the group consisting of *N. gonorrhea* and *N. meningitidis*, *Streptococcus* spp, including *S. pneumoniae*, *S. pyogenes*, *S. agalactiae*, *S. mutans*; *Haemophilus* spp, including *H. influenzae* type B, non typeable *H. influenzae*, *H. ducreyi*; *Moraxella* spp, including

- M catarrhalis, also known as Branhamella catarrhalis; Bordetella spp, including B. pertussis, B. parapertussis and B. bronchiseptica; Mycobacterium spp., including M. tuberculosis, M. bovis, M. leprae, M. avium, M. paratuberculosis, M. smegmatis; Legionella spp, including L. pneumophila; Escherichia spp, including enterotoxigenic E. coli, enterohemorrhagic E. coli, enteropathogenic E. coli; Vibrio spp, including V. cholera, Shigella spp, including S. sonnei, S. dysenteriae, S. flexnerii; Yersinia spp, including Y. enterocolitica, Y. pestis, Y. pseudotuberculosis, Campylobacter spp, including C. jejuni and C. coli; Salmonella spp, including S. typhi, S. paratyphi, S. choleraesuis, S. enteritidis; Listeria spp., including L. monocytogenes; Helicobacter spp, including H. pylori; Pseudomonas spp, including P. aeruginosa, Staphylococcus spp., including S. aureus, S. epidermidis; Enterococcus spp., including E. faecalis, E. faecium; Clostridium spp., including C. tetani, C. botulinum, C. difficile; Bacillus spp., including B. anthracis; Corynebacterium spp., including C. diphtheriae; Borrelia spp., including B. burgdorferi, B. garinii, B. afzelii, B. andersonii, B. hermsii; Ehrlichia spp., including E. equi and the agent of the Human Granulocytic Ehrlichiosis; Rickettsia spp, including R. rickettsii; Chlamydia spp., including C. trachomatis, C. pneumoniae, C. psittaci; Leptospira spp., including L. interrogans; Treponema spp., including T. pallidum, T. denticola, T. hyodysenteriae.
199. The method of claim 198, wherein said bacteria is B. anthracis.
200. The method of claim 192, wherein said protein of interest is anthrax toxins translocating protein (protective antigen precursor [PA]) (SEQ ID NO:209).
201. The method of claim 185, wherein said OSPF-associated disorder is a neoplastic disease.
202. The method of claim 201, wherein said neoplastic disease is selected from the group consisting of breast, colon, non-small cell lung, head and neck, colorectal, lung, prostate, ovary, renal, melanoma, gastrointestinal cancer and osteogenic sarcoma.
203. The method of claim 202, wherein said neoplastic disease is melanoma.

204. The method of claim 192, wherein said protein of interest is melanoma antigen p15 (SEQ ID NO:212).

205. The method of claim 185, wherein said OSPF-associated disorder is a state of toxicity due to a toxin.

206. The method of claim 205, wherein said toxin is selected from the group consisting of botulin, perfringens toxin, pertussis, mycotoxins, shigatoxins, staphylococcal enterotoxin B, tetanus, ricin, cholera, aflatoxins, diphtheria, T2, seguitoxin, saxitoxin, abrin, cyanoginosin, alphatoxin, tetrodotoxin, aconotoxin, snake venom, scorpion venom and spider venoms.

207. The method of claim 206, wherein said toxin is pertussis.

208. The method of claim 192, wherein said protein of interest is pertussis toxin subunit 3 (SEQ ID NO:230).

209. The method of claim 185, wherein said OSPF-associated disorder is a parasitic infection due to a parasite.

210. The method of claim 209, wherein said parasite is selected from the group consisting of Anaplasma, Babesia, Balantidium, Besnoitia, Chlamydia, Coccidia, Cryptospondium, Cytauxzoon, Eimeria Entamoeba, Eperythrozoon, Erlichia, Giardia, Haemobartonella, Hammondia, Isopora, Leishmania, Neorickettsia, Plasmodium, Pneumocystis, Rickettsia, Schistosoma, Sarcocystis, Theileria, Trichinella, Toxoplasma, Trichomonas, Trypanosoma, Uncaria, Dipylidium, Echinococcus, Taenia, Ancylostoma, Ascaris, Enterobius, Strongyloides, Strongylus, Toxocara, Toxascaris and Trichuris.

211. The method of claim 210, wherein said parasite is Plasmodium.

212. The method of claim 192, wherein said protein of interest is selected from the group consisting of circumsporozoite protein precursor (SEQ ID NO:223) and circumsporozoite protein II (SEQ ID NO:224).

5 213. The method of any one of claims 1, 14, 43 70, 156 or 185 further comprising an adjuvant.

214. The method of claim 213, wherein said adjuvant is selected from the group consisting of interleukin (IL)-2, IL-12, IL-15, Freund's adjuvant, corynebacterium
10 parvum and alum.

215. An adjuvant for a vaccine comprising a pharmaceutically acceptable carrier and an overlapping synthetic peptide formulation (OSPF), wherein said OSPF comprises a combination of single chain peptides corresponding to an amino acid
15 sequence of a protein of interest, wherein said single chain peptide is a length represented by Y, wherein Y is at least 7 to (X-1) and X is the number of amino acids of said protein of interest, and wherein at least one single chain peptide overlaps with another single chain peptide by a length of Z, wherein Z is 1 to (Y-1), wherein said
length of said single chain peptide is such that internalization of said single chain
20 peptide by a MHC -bearing cell and presentation by a MHC molecule to a T cell is possible.

216. A adjuvant for a vaccine comprising a pharmaceutically acceptable carrier and an overlapping synthetic peptide formulation (OSPF), wherein said OSPF comprises a
25 combination of single chain peptides corresponding to an amino acid sequence of a protein of interest, wherein said single chain peptides are a length represented by Y, wherein Y is at least 7 to (X-1) and X is the number of amino acids of said protein of interest, wherein said length of said single chain peptides is such that internalization of said single chain peptide by a MHC -bearing cell and presentation by a MHC
30 molecule to a T cell is possible.

217. A method of modulating an immune response comprising contacting a cell with an overlapping synthetic peptide formulation (OPSF) wherein said OPSF

comprises a combination of single chain peptides corresponding to an amino acid sequence of a protein of interest, wherein said single chain peptides are a length represented by Y, wherein Y is at least 7 to (X-1) and X is the number of amino acids of said protein of interest, wherein at least one single chain peptide overlaps with
5 another single chain peptide by a length represented by Z, wherein Z is 1 to (Y-1), wherein said length of said single chain peptide is such that internalization of said single chain peptide by a MHC-bearing cell and presentation by a MHC molecule to a T cell is possible, such that said immune response is modulated.

10 218. A method of modulating an immune response comprising contacting a cell with an overlapping synthetic peptide formulation (OPSF) wherein said OPSF comprises a combination of single chain peptides corresponding to an amino acid sequence of a protein of interest, wherein said single chain peptides are a length represented by Y, wherein Y is at least 7 to (X-1) and X is the number of amino acids
15 of said protein of interest, wherein said length of said single chain peptides are such that internalization of said single chain peptide by a MHC-bearing cell and presentation by a MHC molecule to a T cell is possible, such that said immune response is modulated.

20 219. A method of treating an OSPF-associated disorder comprising contacting a cell with an overlapping synthetic peptide formulation (OPSF) wherein said OPSF comprises a combination of single chain peptides corresponding to an amino acid sequence of a protein of interest, wherein said single chain peptides are a length represented by Y, wherein Y is at least 7 to (X-1) and X is the number of amino acids
25 of said protein of interest, wherein at least one single chain peptide overlaps with another single chain peptide by a length represented by Z, wherein Z is 1 to (Y-1), wherein said length of said single chain peptide is such that internalization of said single chain peptide by a MHC-bearing cell and presentation by a MHC molecule to a T cell is possible, such that said OSPF-associated disorder is treated.

30

220. A method of treating an OSPF-associated disorder comprising contacting a cell with an overlapping synthetic peptide formulation (OPSF) wherein said OPSF comprises a combination of single chain peptides corresponding to an amino acid

sequence of a protein of interest, wherein said single chain peptides are a length represented by Y, wherein Y is at least 7 to (X-1) and X is the number of amino acids of said protein of interest, wherein said length of said single chain peptides are such that internalization of said single chain peptide by a MHC-bearing cell and
5 presentation by a MHC molecule to a T cell is possible, such that said OSPF-associated disorder is treated.

221. A method of preventing an OSPF-associated disorder comprising contacting a cell with an overlapping synthetic peptide formulation (OPSF) wherein said OPSF
10 comprises a combination of single chain peptides corresponding to an amino acid sequence of a protein of interest, wherein said single chain peptides are a length represented by Y, wherein Y is at least 7 to (X-1) and X is the number of amino acids of said protein of interest, wherein at least one single chain peptide overlaps with another single chain peptide by a length represented by Z, wherein Z is 1 to (Y-1),
15 wherein said length of said single chain peptide is such that internalization of said single chain peptide by a MHC-bearing cell and presentation by a MHC molecule to a T cell is possible, such that said OSPF-associated disorder is prevented.

222. A method of preventing an OSPF-associated disorder comprising contacting a
20 cell with an overlapping synthetic peptide formulation (OPSF) wherein said OPSF comprises a combination of single chain peptides corresponding to an amino acid sequence of a protein of interest, wherein said single chain peptides are a length represented by Y, wherein Y is at least 7 to (X-1) and X is the number of amino acids of said protein of interest, wherein said length of said single chain peptides are such
25 that internalization of said single chain peptide by a MHC-bearing cell and presentation by a MHC molecule to a T cell is possible, such that said OSPF-associated disorder is prevented.

223. The method of claims 217-222, wherein said Y is fifteen (15) amino acids.
30

224. The method of claims 217, 219 and 221, wherein said Z is five (5) amino acids.

225. The method of claims 217-222, wherein said immune response is a Th1-mediated immune response.

226. The method of claim 225, wherein said Th1-mediated immune response is a CTL-mediated immune response.

227. The method of claims 217-222, wherein said immune response is a Th2-mediated immune response.

228. The method of claim 227, wherein said Th2-mediated immune response is an antibody-associated immune response.

229. The method of claims 217-222, wherein said MHC-bearing cell is a MHC Class I-bearing cell.

230. The method of claim 229, wherein said MHC Class I-bearing cell is a CTL

231. The method of claims 217-222, wherein said MHC-bearing cell is a MHC Class II-bearing cell.

232. The method of claims 231, wherein said MHC Class II-bearing cell is a B cell.

233. The method of claims 217-222, wherein said protein of interest is selected from the group consisting of HIV Gag protein (SEQ ID NO:339); SIV Envelope protein (SEQ ID NO:340); anthrax toxins translocating protein (protective antigen precursor [PA]) (SEQ ID NO:209); Ebola virus nucleoprotein (SEQ ID NO:210); hepatitis C virus (HCV) polyprotein (SEQ ID NO:211); melanoma antigen p15 (SEQ ID NO:212); human Her2/neu protein (SEQ ID NO:213); respiratory syncytial virus (RSV) fusion protein (SEQ ID NO:214); HIV-2 gp41 protein (SEQ ID NO:215); HIV-2 GAG protein (SEQ ID NO:216); HIV-2 envelope (env) protein (SEQ ID NO:217); HIV-1 vpu protein (SEQ ID NO:218); HIV-1 envelope (env) protein (SEQ ID NO: 219); HIV-1 Tat interactive protein 2 (SEQ ID NO:220); HIV-1 reverse transcriptase (SEQ ID NO:221) and HIV-1 nef protein (SEQ ID NO:222);

circumsporozoite protein precursor (SEQ ID NO:223); circumsporozoite protein II (SEQ ID NO:224); pertussis-like toxin subunit (SEQ ID NO:225); *S. aureus* enterotoxin A (SEQ ID NO:226); *E. coli* enterotoxin A (SEQ ID NO:227); *C. difficile* enterotoxin A (SEQ ID NO:228); *B. cereus* enterotoxin A (SEQ ID NO:229);
5 pertussis toxin subunit 3 (SEQ ID NO:230)); SARS coronavirus (Frankfurt 1) envelope protein E (SEQ ID No:231); Human metapneumovirus fusion protein (SEQ ID NO:232); SARS coronavirus matrix protein (SEQ ID NO: 233); coronavirus nucleocapsid protein (SEQ ID NO: 234); and SARS coronavirus (Frankfurt 1) spike protein S (SEQ ID NO: 235).

10

234. The method of claims 219-222, wherein said OSPF-associated disorder is a viral infection due to a virus.

235. The method of claim 234, wherein said virus is selected from the group
15 consisting of HIV, *e.g.*, HIV-1 and HIV-2, human herpes viruses, cytomegalovirus (esp. Human), Rotavirus, Epstein-Barr virus, Varicella Zoster Virus, hepatitis viruses, such as hepatitis B virus, hepatitis A virus, hepatitis C virus and hepatitis E virus, paramyxoviruses: Respiratory Syncytial virus, parainfluenza virus, Ebola virus, measles virus, mumps virus, human papilloma viruses (for example HPV6, 11, 16, 18
20 and the like), flaviviruses (*e.g.* Yellow Fever Virus, Dengue Virus, Tick-borne encephalitis virus, Japanese Encephalitis Virus) or influenza virus.

236. The method of claim 235, wherein said virus is Ebola virus.

25 237. The method of claims 217-222, wherein said protein of interest is Ebola virus nucleoprotein (SEQ ID NO:210).

238. The method of claims 219-222, wherein said OSPF-associated disorder is a bacterial infection due to a bacteria.

30

239. The method of claim 238, wherein said bacteria is selected from the group consisting of *N. gonorrhea* and *N. meningitidis*, *Streptococcus* spp, including *S. pneumoniae*, *S. pyogenes*, *S. agalactiae*, *S. mutans*; *Haemophilus* spp, including *H.*

influenzae type B, non typeable H. influenzae, H. ducreyi; Moraxella spp, including M catarrhalis, also known as Branhamella catarrhalis; Bordetella spp, including B. pertussis, B. parapertussis and B. bronchiseptica; Mycobacterium spp., including M. tuberculosis, M. bovis, M. leprae, M. avium, M. paratuberculosis, M. smegmatis;

5 Legionella spp, including L. pneumophila; Escherichia spp, including enterotoxigenic E. coli, enterohemorrhagic E. coli, enteropathogenic E. coli; Vibrio spp, including V. cholera, Shigella spp, including S. sonnei, S. dysenteriae, S. flexnerii; Yersinia spp, including Y. enterocolitica, Y. pestis, Y. pseudotuberculosis, Campylobacter spp, including C. jejuni and C. coli; Salmonella spp, including S. typhi, S. paratyphi, S.

10 choleraesuis, S. enteritidis; Listeria spp., including L. monocytogenes; Helicobacter spp, including H. pylori; Pseudomonas spp, including P. aeruginosa, Staphylococcus spp., including S. aureus, S. epidermidis; Enterococcus spp., including E. faecalis, E. faecium; Clostridium spp., including C. tetani, C. botulinum, C. difficile; Bacillus spp., including B. anthracis; Corynebacterium spp., including C. diphtheriae; Borrelia

15 spp., including B. burgdorferi, B. garinii, B. afzelii, B. andersonii, B. hermsii; Ehrlichia spp., including E. equi and the agent of the Human Granulocytic Ehrlichiosis; Rickettsia spp, including R. rickettsii; Chlamydia spp., including C. trachomatis, C. pneumoniae, C. psittaci; Leptospira spp., including L. interrogans; Treponema spp., including T. pallidum, T. denticola, T. hyodysenteriae.

20

240. The method of claim 239, wherein said bacteria is B. anthracis.

241. The method of claims 217-222, wherein said protein of interest is anthrax toxins translocating protein (protective antigen precursor [PA]) (SEQ ID NO:209).

25

242. The method of claims 219-222, wherein said OSPF-associated disorder is a neoplastic disease.

243. The method of claim 242, wherein said neoplastic disease is selected from the group consisting of breast, colon, non-small cell lung, head and neck, colorectal, lung, prostate, ovary, renal, melanoma, gastrointestinal cancer and osteogenic sarcoma.

30

244. The method of claim 243, wherein said neoplastic disease is melanoma.

245. The method of claims 217-222, wherein said protein of interest is melanoma antigen p15 (SEQ ID NO:212).

- 5 246. The method of claims 219-222, wherein said OSPF-associated disorder is a state of toxicity due to a toxin.

247. The method of claim 246, wherein said toxin is selected from the group consisting of botulin, perfringens toxin, pertussis, mycotoxins, shigatoxins,
10 staphylococcal enterotoxin B, tetanus, ricin, cholera, aflatoxins, diphtheria, T2, seguitoxin, saxitoxin, abrin, cyanoginosin, alphatoxin, tetrodotoxin, aconotoxin, snake venom, scorpion venom and spider venoms.

248. The method of claim 246, wherein said toxin is pertussis.

15

249. The method of claims 217-222, wherein said protein of interest is pertussis toxin subunit 3 (SEQ ID NO:230).

250. The method of claims 219-222, wherein said OSPF-associated disorder is a
20 parasitic infection due to a parasite.

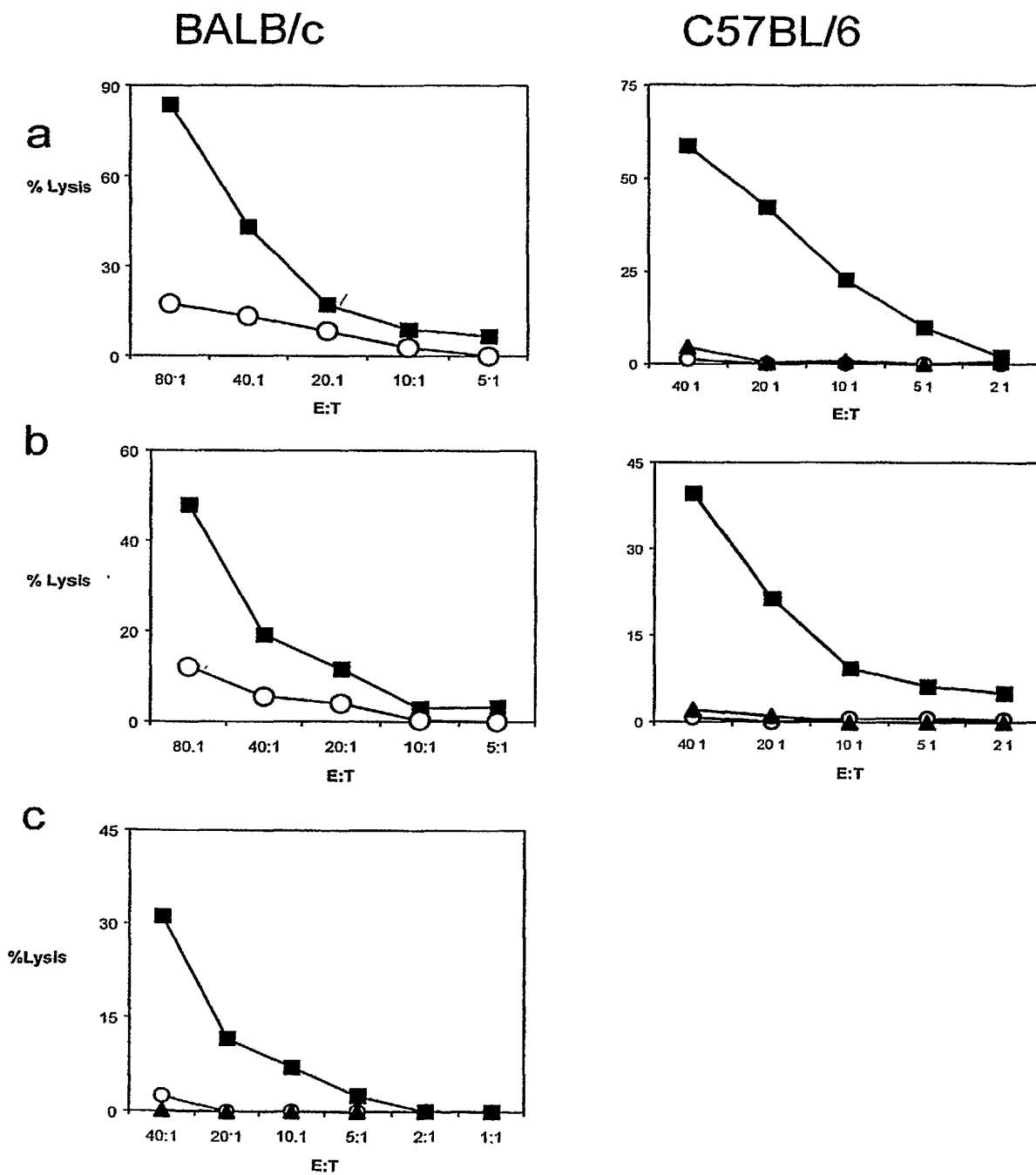
251. The method of claim 250, wherein said parasite is selected from the group consisting of Anaplasma, Babesia, Balantidium, Besnoitia, Chlamydia, Coccidia, Cryptosondium, Cytauxzoon, Eimeria Entamoeba, Eperythrozoon, Erlichia, Giardia,
25 Haemobartonella, Hammondia, Isopora, Leishmania, Neorickettsia, Plasmodium, Pneumocystis, Rickettsia, Schistosoma, Sarcocystis, Theileria, Trichinella, Toxoplasma, Trichomonas, Trypanosoma, Unicaria, Dipylidium, Echinococcuse, Taenia, Ancylostoma, Ascaris, Enterobius, Strongyloides, Strongylus, Toxocara, Toxascaris and Trichuris.

30

252. The method of claim 251, wherein said parasite is Plasmodium.

253. The method of claims 217-222, wherein said protein of interest is circumsporozoite protein II (SEQ ID NO:224).

Fig. 1



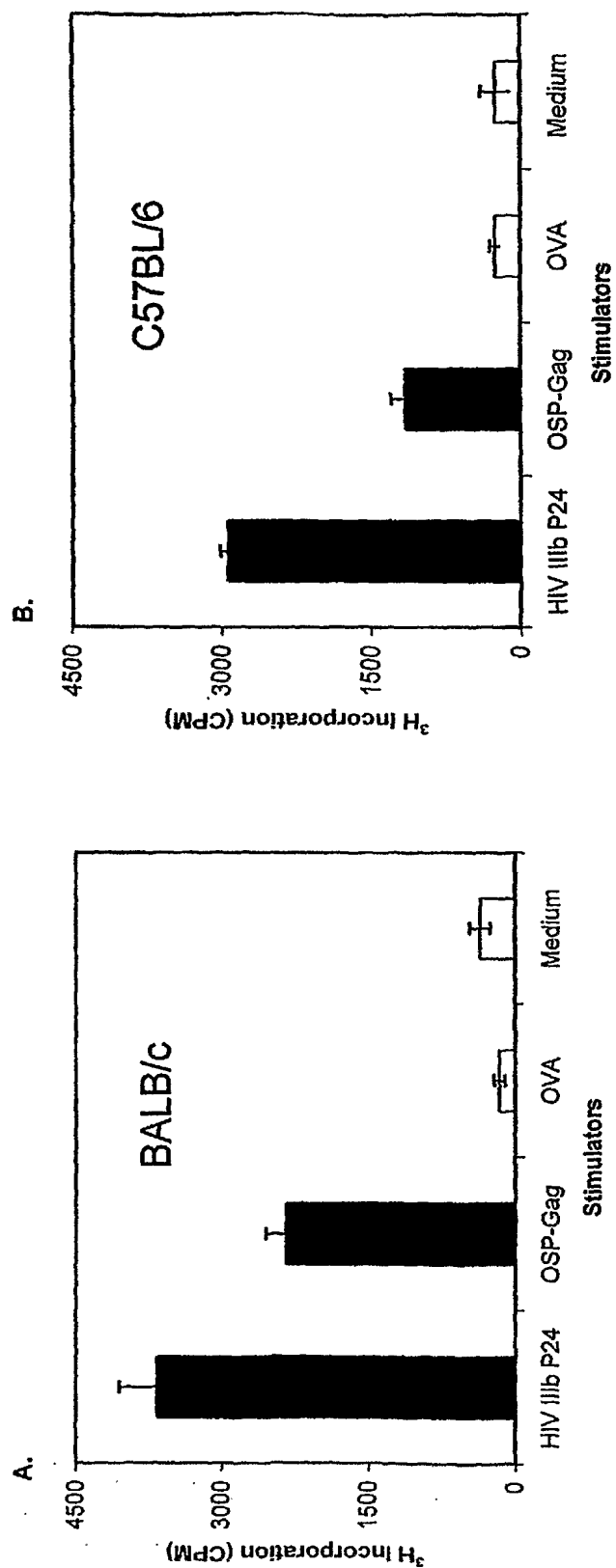
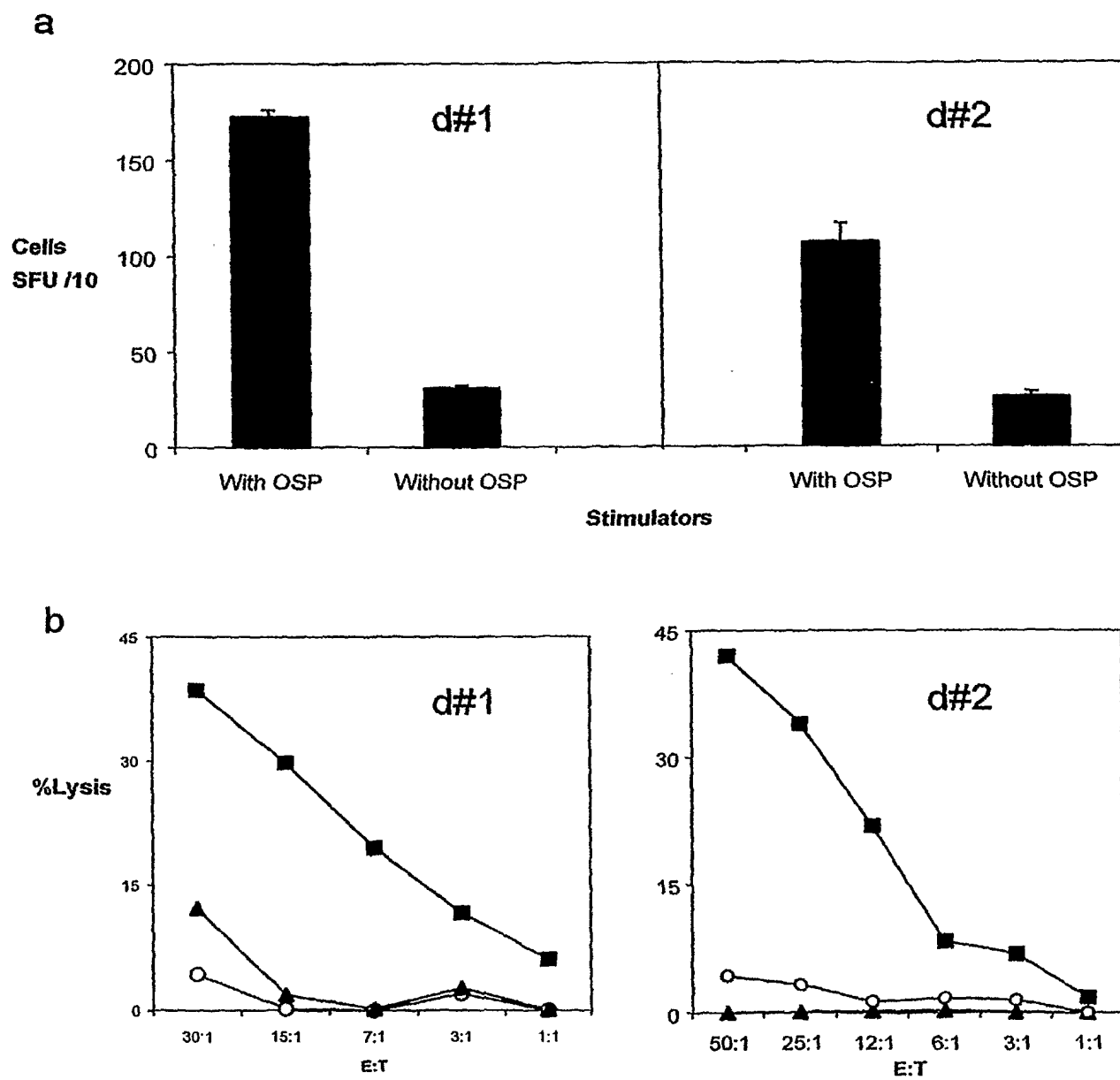


Fig. 2

Fig. 3



SEQUENCE LISTING

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<120> COMPOSITIONS AND METHODS FOR MODULATING
A CYTOTOXIC T LYMPHOCYTE IMMUNE RESPONSE

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5/91

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6/91

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<213> Human Immunodeficiency Virus

<400> 32
Ser Asn Lys Val Ser Gln Asn Tyr Pro Ile Val Gln Asn Ile Gln
1 5 10 15

<210> 33
<211> 15
<212> PRT
<213> Human Immunodeficiency Virus

<400> 33
Ser Gln Asn Tyr Pro Ile Val Gln Asn Ile Gln Gly Gln Met Val
1 5 10 15

<210> 34
<211> 15
<212> PRT
<213> Human Immunodeficiency Virus

<400> 34
Pro Ile Val Gln Asn Ile Gln Gly Gln Met Val His Gln Ala Ile
1 5 10 15

<210> 35
<211> 15
<212> PRT
<213> Human Immunodeficiency Virus

<400> 35
Asn Ile Gln Gly Gln Met Val His Gln Ala Ile Ser Pro Arg Thr
1 5 10 15

<210> 36
<211> 15
<212> PRT
<213> Human Immunodeficiency Virus

<400> 36
Gln Met Val His Gln Ala Ile Ser Pro Arg Thr Leu Asn Ala Trp
1 5 10 15

<210> 37
<211> 15
<212> PRT
<213> Human Immunodeficiency Virus

<400> 37
Gln Ala Ile Ser Pro Arg Thr Leu Asn Ala Trp Val Lys Val Val
1 5 10 15

<210> 38
<211> 15
<212> PRT
<213> Human Immunodeficiency Virus

<400> 38
Pro Arg Thr Leu Asn Ala Trp Val Lys Val Val Glu Glu Lys Ala
1 5 10 15

<210> 39
<211> 15
<212> PRT
<213> Human Immunodeficiency Virus

<400> 39
Asn Ala Trp Val Lys Val Val Glu Glu Lys Ala Phe Ser Pro Glu
1 5 10 15

<210> 40
<211> 15
<212> PRT
<213> Human Immunodeficiency Virus

<400> 40
Lys Val Val Glu Glu Lys Ala Phe Ser Pro Glu Val Ile Pro Met
1 5 10 15

<210> 41
<211> 15
<212> PRT
<213> Human Immunodeficiency Virus

<400> 41
Glu Lys Ala Phe Ser Pro Glu Val Ile Pro Met Phe Ser Ala Leu
1 5 10 15

<210> 42
<211> 15
<212> PRT
<213> Human Immunodeficiency Virus

<400> 42
Ser Pro Glu Val Ile Pro Met Phe Ser Ala Leu Ser Glu Gly Ala
1 5 10 15

<210> 43
<211> 15
<212> PRT
<213> Human Immunodeficiency Virus

<400> 43
Ile Pro Met Phe Ser Ala Leu Ser Glu Gly Ala Thr Pro Gln Asp
1 5 10 15

<210> 44
<211> 15
<212> PRT
<213> Human Immunodeficiency Virus

<400> 44
Ser Ala Leu Ser Glu Gly Ala Thr Pro Gln Asp Leu Asn Thr Met
1 5 10 15

<210> 45
<211> 15
<212> PRT
<213> Human Immunodeficiency Virus

<400> 45
Glu Gly Ala Thr Pro Gln Asp Leu Asn Thr Met Leu Asn Thr Val
1 5 10 15

<210> 46
<211> 15
<212> PRT
<213> Human Immunodeficiency Virus

<400> 46
Pro Gln Asp Leu Asn Thr Met Leu Asn Thr Val Gly Gly His Gln
1 5 10 15

<210> 47
<211> 15
<212> PRT
<213> Human Immunodeficiency Virus

<400> 47
Asn Thr Met Leu Asn Thr Val Gly Gly His Gln Ala Ala Met Gln
1 5 10 15

<210> 48
<211> 15
<212> PRT
<213> Human Immunodeficiency Virus

<400> 48
Asn Thr Val Gly Gly His Gln Ala Ala Met Gln Met Leu Lys Glu
1 5 10 15

<210> 49
<211> 15
<212> PRT
<213> Human Immunodeficiency Virus

<400> 49
Gly His Gln Ala Ala Met Gln Met Leu Lys Glu Thr Ile Asn Glu
1 5 10 15

<210> 50
<211> 15
<212> PRT
<213> Human Immunodeficiency Virus

<400> 50
Ala Met Gln Met Leu Lys Glu Thr Ile Asn Glu Glu Ala Ala Glu
1 5 10 15

<210> 51
<211> 15
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<213> Human Immunodeficiency Virus

<400> 51
Leu Lys Glu Thr Ile Asn Glu Glu Ala Ala Glu Trp Asp Arg Val
1 5 10 15

<210> 52
<211> 15
<212> PRT
<213> Human Immunodeficiency Virus

<400> 52
Ile Asn Glu Glu Ala Ala Glu Trp Asp Arg Val His Pro Val His
1 5 10 15

<210> 53
<211> 15
<212> PRT
<213> Human Immunodeficiency Virus

<400> 53
Ala Ala Glu Trp Asp Arg Val His Pro Val His Ala Gly Pro Ile
1 5 10 15

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<210> 54
<211> 15
<212> PRT
<213> Human Immunodeficiency Virus

<400> 54
Asp Arg Val His Pro Val His Ala Gly Pro Ile Ala Pro Gly Gln
1 5 10 15

<210> 55
<211> 15
<212> PRT
<213> Human Immunodeficiency Virus

<400> 55
Pro Val His Ala Gly Pro Ile Ala Pro Gly Gln Met Arg Glu Pro
1 5 10 15

<210> 56
<211> 15
<212> PRT
<213> Human Immunodeficiency Virus

<400> 56
Gly Pro Ile Ala Pro Gly Gln Met Arg Glu Pro Arg Gly Ser Asp
1 5 10 15

<210> 57
<211> 15
<212> PRT
<213> Human Immunodeficiency Virus

<400> 57
Pro Gly Gln Met Arg Glu Pro Arg Gly Ser Asp Ile Ala Gly Thr
1 5 10 15

<210> 58
<211> 15
<212> PRT
<213> Human Immunodeficiency Virus

<400> 58
Arg Glu Pro Arg Gly Ser Asp Ile Ala Gly Thr Thr Ser Thr Leu
1 5 10 15

<210> 59
<211> 15
<212> PRT
<213> Human Immunodeficiency Virus

<400> 59
Gly Ser Asp Ile Ala Gly Thr Thr Ser Thr Leu Gln Glu Gln Ile
1 5 10 15

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<210> 60
<211> 15
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<213> Human Immunodeficiency Virus

<400> 60
Ala Gly Thr Thr Ser Thr Leu Gln Glu Gln Ile Gly Trp Met Thr
1 5 10 15

<210> 61
<211> 15
<212> PRT
<213> Human Immunodeficiency Virus

<400> 61
Ser Thr Leu Gln Glu Gln Ile Gly Trp Met Thr Asn Asn Pro Pro
1 5 10 15

<210> 62
<211> 15
<212> PRT
<213> Human Immunodeficiency Virus

<400> 62
Glu Gln Ile Gly Trp Met Thr Asn Asn Pro Pro Ile Pro Val Gly
1 5 10 15

<210> 63
<211> 15
<212> PRT
<213> Human Immunodeficiency Virus

<400> 63
Trp Met Thr Asn Asn Pro Pro Ile Pro Val Gly Glu Ile Tyr Lys
1 5 10 15

<210> 64
<211> 15
<212> PRT
<213> Human Immunodeficiency Virus

<400> 64
Asn Pro Pro Ile Pro Val Gly Glu Ile Tyr Lys Arg Trp Ile Ile
1 5 10 15

<210> 65
<211> 15
<212> PRT
<213> Human Immunodeficiency Virus

<400> 65
Pro Val Gly Glu Ile Tyr Lys Arg Trp Ile Ile Leu Gly Leu Asn
1 5 10 15

<210> 66

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<211> 15
<212> PRT
<213> Human Immunodeficiency Virus

<400> 66
Ile Tyr Lys Arg Trp Ile Ile Leu Gly Leu Asn Lys Ile Val Arg
1 5 10 15

<210> 67
<211> 15
<212> PRT
<213> Human Immunodeficiency Virus

<400> 67
Trp Ile Ile Leu Gly Leu Asn Lys Ile Val Arg Met Tyr Ser Pro
1 5 10 15

<210> 68
<211> 15
<212> PRT
<213> Human Immunodeficiency Virus

<400> 68
Gly Leu Asn Lys Ile Val Arg Met Tyr Ser Pro Thr Ser Ile Leu
1 5 10 15

<210> 69
<211> 15
<212> PRT
<213> Human Immunodeficiency Virus

<400> 69
Ile Val Arg Met Tyr Ser Pro Thr Ser Ile Leu Asp Ile Arg Gln
1 5 10 15

<210> 70
<211> 15
<212> PRT
<213> Human Immunodeficiency Virus

<400> 70
Tyr Ser Pro Thr Ser Ile Leu Asp Ile Arg Gln Gly Pro Lys Glu
1 5 10 15

<210> 71
<211> 15
<212> PRT
<213> Human Immunodeficiency Virus

<400> 71
Ser Ile Leu Asp Ile Arg Gln Gly Pro Lys Glu Pro Phe Arg Asp
1 5 10 15

<210> 72
<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 72

Ile	Arg	Gln	Gly	Pro	Lys	Glu	Pro	Phe	Arg	Asp	Tyr	Val	Asp	Arg
1				5					10				15	

<210> 73

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 73

Pro	Lys	Glu	Pro	Phe	Arg	Asp	Tyr	Val	Asp	Arg	Phe	Tyr	Lys	Thr
1				5					10				15	

<210> 74

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 74

Phe	Arg	Asp	Tyr	Val	Asp	Arg	Phe	Tyr	Lys	Thr	Leu	Arg	Ala	Glu
1				5					10				15	

<210> 75

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 75

Val	Asp	Arg	Phe	Tyr	Lys	Thr	Leu	Arg	Ala	Glu	Gln	Ala	Ser	Gln
1				5					10				15	

<210> 76

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 76

Tyr	Lys	Thr	Leu	Arg	Ala	Glu	Gln	Ala	Ser	Gln	Glu	Val	Lys	Asn
1				5					10				15	

<210> 77

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 77

Arg	Ala	Glu	Gln	Ala	Ser	Gln	Glu	Val	Lys	Asn	Trp	Met	Thr	Glu
1				5					10				15	

<210> 78

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 78

Ala	Ser	Gln	Glu	Val	Lys	Asn	Trp	Met	Thr	Glu	Thr	Leu	Leu	Val
1				5					10				15	

<210> 79

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 79

Val	Lys	Asn	Trp	Met	Thr	Glu	Thr	Leu	Leu	Val	Gln	Asn	Ala	Asn
1				5				10					15	

<210> 80

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 80

Met	Thr	Glu	Thr	Leu	Leu	Val	Gln	Asn	Ala	Asn	Pro	Asp	Cys	Lys
1				5				10					15	

<210> 81

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 81

Leu	Leu	Val	Gln	Asn	Ala	Asn	Pro	Asp	Cys	Lys	Thr	Ile	Leu	Lys
1				5				10					15	

<210> 82

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 82

Asn	Ala	Asn	Pro	Asp	Cys	Lys	Thr	Ile	Leu	Lys	Ala	Leu	Gly	Pro
1				5				10					15	

<210> 83

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 83

Asp	Cys	Lys	Thr	Ile	Leu	Lys	Ala	Leu	Gly	Pro	Ala	Ala	Thr	Leu
1				5				10					15	

<210> 84

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 84

Ile	Leu	Lys	Ala	Leu	Gly	Pro	Ala	Ala	Thr	Leu	Glu	Glu	Met	Met
1				5					10					15

<210> 85

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 85

Leu	Gly	Pro	Ala	Ala	Thr	Leu	Glu	Glu	Met	Met	Thr	Ala	Cys	Gln
1				5					10					15

<210> 86

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 86

Ala	Thr	Leu	Glu	Glu	Met	Met	Thr	Ala	Cys	Gln	Gly	Val	Gly	Gly
1				5					10					15

<210> 87

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 87

Glu	Met	Met	Thr	Ala	Cys	Gln	Gly	Val	Gly	Gly	Pro	Gly	His	Lys
1				5					10					15

<210> 88

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 88

Ala	Cys	Gln	Gly	Val	Gly	Gly	Pro	Gly	His	Lys	Ala	Arg	Val	Leu
1				5					10					15

<210> 89

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 89

Val	Gly	Gly	Pro	Gly	His	Lys	Ala	Arg	Val	Leu	Ala	Glu	Ala	Met
1				5					10					15

<210> 90

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 90

Gly	His	Lys	Ala	Arg	Val	Leu	Ala	Glu	Ala	Met	Ser	Gln	Val	Thr
1				5				10					15	

<210> 91

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 91

Arg	Val	Leu	Ala	Glu	Ala	Met	Ser	Gln	Val	Thr	Asn	Ser	Ala	Thr
1				5				10					15	

<210> 92

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 92

Glu	Ala	Met	Ser	Gln	Val	Thr	Asn	Ser	Ala	Thr	Ile	Met	Met	Gln
1				5				10					15	

<210> 93

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 93

Gln	Val	Thr	Asn	Ser	Ala	Thr	Ile	Met	Met	Gln	Arg	Gly	Asn	Phe
1				5				10					15	

<210> 94

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 94

Ser	Ala	Thr	Ile	Met	Met	Gln	Arg	Gly	Asn	Phe	Arg	Asn	Gln	Arg
1				5				10					15	

<210> 95

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 95

Met	Met	Gln	Arg	Gly	Asn	Phe	Arg	Asn	Gln	Arg	Lys	Ile	Val	Lys
1				5				10					15	

<210> 96

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 96

Gly	Asn	Phe	Arg	Asn	Gln	Arg	Lys	Ile	Val	Lys	Cys	Phe	Asn	Cys
1				5					10					15

<210> 97

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 97

Asn	Gln	Arg	Lys	Ile	Val	Lys	Cys	Phe	Asn	Cys	Gly	Lys	Glu	Gly
1				5					10					15

<210> 98

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 98

Ile	Val	Lys	Cys	Phe	Asn	Cys	Gly	Lys	Glu	Gly	His	Thr	Ala	Arg
1				5					10					15

<210> 99

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 99

Phe	Asn	Cys	Gly	Lys	Glu	Gly	His	Thr	Ala	Arg	Asn	Cys	Arg	Ala
1				5					10					15

<210> 100

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 100

Lys	Glu	Gly	His	Thr	Ala	Arg	Asn	Cys	Arg	Ala	Pro	Arg	Lys	Lys
1				5					10					15

<210> 101

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 101

Thr	Ala	Arg	Asn	Cys	Arg	Ala	Pro	Arg	Lys	Lys	Gly	Cys	Trp	Lys
1				5					10					15

<210> 102

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 102

Cys	Arg	Ala	Pro	Arg	Lys	Lys	Gly	Cys	Trp	Lys	Cys	Gly	Lys	Glu
1				5					10					15

<210> 103

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 103

Arg	Lys	Lys	Gly	Cys	Trp	Lys	Cys	Gly	Lys	Glu	Gly	His	Gln	Met
1				5					10					15

<210> 104

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 104

Cys	Trp	Lys	Cys	Gly	Lys	Glu	Gly	His	Gln	Met	Lys	Asp	Cys	Thr
1				5					10					15

<210> 105

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 105

Gly	Lys	Glu	Gly	His	Gln	Met	Lys	Asp	Cys	Thr	Glu	Arg	Gln	Ala
1				5					10					15

<210> 106

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 106

His	Gln	Met	Lys	Asp	Cys	Thr	Glu	Arg	Gln	Ala	Asn	Phe	Leu	Gly
1				5					10					15

<210> 107

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 107

Asp	Cys	Thr	Glu	Arg	Gln	Ala	Asn	Phe	Leu	Gly	Lys	Ile	Trp	Pro
1				5					10					15

<210> 108

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

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<400> 108

Arg	Gln	Ala	Asn	Phe	Leu	Gly	Lys	Ile	Trp	Pro	Ser	Tyr	Lys	Gly
1				5					10					15

<210> 109

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 109

Phe	Leu	Gly	Lys	Ile	Trp	Pro	Ser	Tyr	Lys	Gly	Arg	Pro	Gly	Asn
1				5					10					15

<210> 110

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 110

Ile	Trp	Pro	Ser	Tyr	Lys	Gly	Arg	Pro	Gly	Asn	Phe	Leu	Gln	Ser
1				5					10					15

<210> 111

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 111

Tyr	Lys	Gly	Arg	Pro	Gly	Asn	Phe	Leu	Gln	Ser	Arg	Pro	Glu	Pro
1				5					10					15

<210> 112

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 112

Pro	Gly	Asn	Phe	Leu	Gln	Ser	Arg	Pro	Glu	Pro	Thr	Ala	Pro	Pro
1				5					10					15

<210> 113

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 113

Leu	Gln	Ser	Arg	Pro	Glu	Pro	Thr	Ala	Pro	Pro	Glu	Glu	Ser	Phe
1				5					10					15

<210> 114

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 114

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Pro Glu Pro Thr Ala Pro Pro Glu Glu Ser Phe Arg Ser Gly Val
1 5 10 15

<210> 115

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 115

Ala Pro Pro Glu Glu Ser Phe Arg Ser Gly Val Glu Thr Thr Thr
1 5 10 15

<210> 116

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 116

Glu Ser Phe Arg Ser Gly Val Glu Thr Thr Thr Pro Pro Gln Lys
1 5 10 15

<210> 117

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 117

Ser Gly Val Glu Thr Thr Thr Pro Pro Gln Lys Gln Glu Pro Ile
1 5 10 15

<210> 118

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 118

Thr Thr Thr Pro Pro Gln Lys Gln Glu Pro Ile Asp Lys Glu Leu
1 5 10 15

<210> 119

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 119

Pro Gln Lys Gln Glu Pro Ile Asp Lys Glu Leu Tyr Pro Leu Thr
1 5 10 15

<210> 120

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 120

Glu Pro Ile Asp Lys Glu Leu Tyr Pro Leu Thr Ser Leu Arg Ser

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1

5

10

15

<210> 121

<211> 15

<212> PRT

<213> Human Immunodeficiency Virus

<400> 121

Lys	Glu	Leu	Tyr	Pro	Leu	Thr	Ser	Leu	Arg	Ser	Leu	Phe	Gly	Asn
1				5				10					15	

<210> 122

<211> 16

<212> PRT

<213> Human Immunodeficiency Virus

<400> 122

Pro	Leu	Thr	Ser	Leu	Arg	Ser	Leu	Phe	Gly	Asn	Asp	Pro	Ser	Ser	Gln
1				5				10						15	

<210> 123

<211> 20

<212> PRT

<213> Simian Immunodeficiency Virus

<400> 123

Met	Gly	Cys	Leu	Gly	Asn	Gln	Leu	Leu	Ile	Ala	Ile	Leu	Leu	Leu	Ser
1				5				10						15	
Val	Tyr	Gly	Ile												
			20												

<210> 124

<211> 20

<212> PRT

<213> Simian Immunodeficiency Virus

<400> 124

Ala	Ile	Leu	Leu	Leu	Ser	Val	Tyr	Gly	Ile	Tyr	Cys	Thr	Leu	Tyr	Val
1				5				10						15	
Thr	Val	Phe	Tyr												
			20												

<210> 125

<211> 20

<212> PRT

<213> Simian Immunodeficiency Virus

<400> 125

Tyr	Cys	Thr	Leu	Tyr	Val	Thr	Val	Phe	Tyr	Gly	Val	Pro	Ala	Trp	Arg
1				5				10						15	
Asn	Ala	Thr	Ile												
			20												

<210> 126

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<211> 20
<212> PRT
<213> Simian Immunodeficiency Virus

<400> 126
Gly Val Pro Ala Trp Arg Asn Ala Thr Ile Pro Leu Phe Cys Ala Thr
1 5 10 15
Lys Asn Arg Asp
20

<210> 127
<211> 20
<212> PRT
<213> Simian Immunodeficiency Virus

<400> 127
Pro Leu Phe Cys Ala Thr Lys Asn Arg Asp Thr Trp Gly Thr Thr Gln
1 5 10 15
Cys Leu Pro Asp
20

<210> 128
<211> 20
<212> PRT
<213> Simian Immunodeficiency Virus

<400> 128
Thr Trp Gly Thr Thr Gln Cys Leu Pro Asp Asn Gly Asp Tyr Ser Glu
1 5 10 15
Val Ala Leu Asn
20

<210> 129
<211> 20
<212> PRT
<213> Simian Immunodeficiency Virus

<400> 129
Asn Gly Asp Tyr Ser Glu Val Ala Leu Asn Val Thr Glu Ser Phe Asp
1 5 10 15
Ala Trp Asn Asn
20

<210> 130
<211> 20
<212> PRT
<213> Simian Immunodeficiency Virus

<400> 130
Val Thr Glu Ser Phe Asp Ala Trp Asn Asn Thr Val Thr Glu Gln Ala
1 5 10 15
Ile Glu Asp Val
20

<210> 131
<211> 20

<212> PRT

<213> Simian Immunodeficiency Virus

<400> 131

Thr	Val	Thr	Glu	Gln	Ala	Ile	Glu	Asp	Val	Trp	Gln	Leu	Phe	Glu	Thr
1				5					10					15	
Ser	Ile	Lys	Pro												
			20												

<210> 132

<211> 20

<212> PRT

<213> Simian Immunodeficiency Virus

<400> 132

Trp	Gln	Leu	Phe	Glu	Thr	Ser	Ile	Lys	Pro	Cys	Val	Lys	Leu	Ser	Pro
1				5					10					15	
Leu	Cys	Ile	Thr												
			20												

<210> 133

<211> 20

<212> PRT

<213> Simian Immunodeficiency Virus

<400> 133

Cys	Val	Lys	Leu	Ser	Pro	Leu	Cys	Ile	Thr	Met	Arg	Cys	Asn	Lys	Ser
1				5					10					15	
Glu	Thr	Asp	Arg												
			20												

<210> 134

<211> 20

<212> PRT

<213> Simian Immunodeficiency Virus

<400> 134

Met	Arg	Cys	Asn	Lys	Ser	Glu	Thr	Asp	Arg	Trp	Gly	Leu	Thr	Lys	Ser
1				5					10					15	
Ile	Thr	Thr	Thr												
			20												

<210> 135

<211> 20

<212> PRT

<213> Simian Immunodeficiency Virus

<400> 135

Trp	Gly	Leu	Thr	Lys	Ser	Ile	Thr	Thr	Thr	Ala	Ser	Thr	Thr	Ser	Thr
1				5					10					15	
Thr	Ala	Ser	Ala												
			20												

<210> 136

<211> 20

<212> PRT

<213> Simian Immunodeficiency Virus

<400> 136

Ala	Ser	Thr	Thr	Ser	Thr	Thr	Ala	Ser	Ala	Lys	Val	Asp	Met	Val	Asn
1				5					10					15	
Glu	Thr	Ser	Ser												
			20												

<210> 137

<211> 20

<212> PRT

<213> Simian Immunodeficiency Virus

<400> 137

Lys	Val	Asp	Met	Val	Asn	Glu	Thr	Ser	Ser	Cys	Ile	Ala	Gln	Asp	Asn
1				5					10					15	
Cys	Thr	Gly	Leu												
			20												

<210> 138

<211> 20

<212> PRT

<213> Simian Immunodeficiency Virus

<400> 138

Cys	Ile	Ala	Gln	Asp	Asn	Cys	Thr	Gly	Leu	Glu	Gln	Glu	Gln	Met	Ile
1				5					10					15	
Ser	Cys	Lys	Phe												
			20												

<210> 139

<211> 20

<212> PRT

<213> Simian Immunodeficiency Virus

<400> 139

Glu	Gln	Glu	Gln	Met	Ile	Ser	Cys	Lys	Phe	Asn	Met	Thr	Gly	Leu	Lys
1				5					10					15	
Arg	Asp	Lys	Lys												
			20												

<210> 140

<211> 20

<212> PRT

<213> Simian Immunodeficiency Virus

<400> 140

Asn	Met	Thr	Gly	Leu	Lys	Arg	Asp	Lys	Lys	Lys	Glu	Tyr	Asn	Glu	Thr
1				5					10					15	
Trp	Tyr	Ser	Ala												
			20												

<210> 141

<211> 20

<212> PRT

<213> Simian Immunodeficiency Virus

<400> 141

Lys Glu Tyr Asn Glu Thr Trp Tyr Ser Ala Asp Leu Val Cys Glu Gln
1 5 10 15
Gly Asn Asn Thr
20

<210> 142

<211> 20

<212> PRT

<213> Simian Immunodeficiency Virus

<400> 142

Asp Leu Val Cys Glu Gln Gly Asn Asn¹ Thr Gly Asn Glu Ser Arg Cys
1 5 10 15
Tyr Met Asn His
20

<210> 143

<211> 20

<212> PRT

<213> Simian Immunodeficiency Virus

<400> 143

Gly Asn Glu Ser Arg Cys Tyr Met Asn His Cys Asn Thr Ser Val Ile
1 5 10 15
Gln Glu Ser Cys
20

<210> 144

<211> 20

<212> PRT

<213> Simian Immunodeficiency Virus

<400> 144

Cys Asn Thr Ser Val Ile Gln Glu Ser Cys Asp Lys His Tyr Trp Asp
1 5 10 15
Ala Ile Arg Phe
20

<210> 145

<211> 20

<212> PRT

<213> Simian Immunodeficiency Virus

<400> 145

Asp Lys His Tyr Trp Asp Ala Ile Arg Phe Arg Tyr Cys Ala Pro Pro
1 5 10 15
Gly Tyr Ala Leu
20

<210> 146

<211> 20

<212> PRT

<213> Simian Immunodeficiency Virus

<400> 146

Arg	Tyr	Cys	Ala	Pro	Pro	Gly	Tyr	Ala	Leu	Leu	Arg	Cys	Asn	Asp	Thr
1				5					10					15	
Asn	Tyr	Ser	Gly												
			20												

<210> 147

<211> 20

<212> PRT

<213> Simian Immunodeficiency Virus

<400> 147

Leu	Arg	Cys	Asn	Asp	Thr	Asn	Tyr	Ser	Gly	Phe	Met	Pro	Lys	Cys	Ser
1				5					10					15	
Lys	Val	Val	Val												
			20												

<210> 148

<211> 20

<212> PRT

<213> Simian Immunodeficiency Virus

<400> 148

Phe	Met	Pro	Lys	Cys	Ser	Lys	Val	Val	Val	Ser	Ser	Cys	Thr	Arg	Met
1				5					10					15	
Met	Glu	Thr	Gln												
			20												

<210> 149

<211> 20

<212> PRT

<213> Simian Immunodeficiency Virus

<400> 149

Ser	Ser	Cys	Thr	Arg	Met	Met	Glu	Thr	Gln	Thr	Ser	Thr	Trp	Phe	Gly
1				5					10					15	
Phe	Asn	Gly	Thr												
			20												

<210> 150

<211> 20

<212> PRT

<213> Simian Immunodeficiency Virus

<400> 150

Thr	Ser	Thr	Trp	Phe	Gly	Phe	Asn	Gly	Thr	Arg	Ala	Glu	Asn	Arg	Thr
1				5					10					15	
Tyr	Ile	Tyr	Trp												
			20												

<210> 151

<211> 20

<212> PRT

<213> Simian Immunodeficiency Virus

<400> 151

27/91

Arg Ala Glu Asn Arg Thr Tyr Ile Tyr Trp His Gly Arg Asp Asn Arg
1 5 10 15
Thr Ile Ile Ser
20

<210> 152
<211> 20
<212> PRT
<213> Simian Immunodeficiency Virus

<400> 152
His Gly Arg Asp Asn Arg Thr Ile Ile Ser Leu Asn Lys Tyr Tyr Asn
1 5 10 15
Leu Thr Met Lys
20

<210> 153
<211> 20
<212> PRT
<213> Simian Immunodeficiency Virus

<400> 153
Leu Asn Lys Tyr Tyr Asn Leu Thr Met Lys Cys Arg Arg Pro Gly Asn
1 5 10 15
Lys Thr Val Leu
20

<210> 154
<211> 20
<212> PRT
<213> Simian Immunodeficiency Virus

<400> 154
Cys Arg Arg Pro Gly Asn Lys Thr Val Leu Pro Val Thr Ile Met Ser
1 5 10 15
Gly Leu Val Phe
20

<210> 155
<211> 20
<212> PRT
<213> Simian Immunodeficiency Virus

<400> 155
Pro Val Thr Ile Met Ser Gly Leu Val Phe His Ser Gln Pro Ile Asn
1 5 10 15
Asp Arg Pro Lys
20

<210> 156
<211> 20
<212> PRT
<213> Simian Immunodeficiency Virus

<400> 156
His Ser Gln Pro Ile Asn Asp Arg Pro Lys Gln Ala Trp Cys Trp Phe

28/91

1	5	10	15
Gly Gly Lys Trp			
20			

<210> 157
<211> 20
<212> PRT
<213> Simian Immunodeficiency Virus

<400> 157			
Gln Ala Trp Cys Trp Phe Gly Gly Lys Trp Lys Asp Ala Ile Lys Glu			
1 5 10 15			
Val Lys Gln Thr			
20			

<210> 158
<211> 20
<212> PRT
<213> Simian Immunodeficiency Virus

<400> 158			
Lys Asp Ala Ile Lys Glu Val Lys Gln Thr Ile Val Lys His Pro Arg			
1 5 10 15			
Tyr Thr Gly Thr			
20			

<210> 159
<211> 20
<212> PRT
<213> Simian Immunodeficiency Virus

<400> 159			
Ile Val Lys His Pro Arg Tyr Thr Gly Thr Asn Asn Thr Asp Lys Ile			
1 5 10 15			
Asn Leu Thr Ala			
20			

<210> 160
<211> 20
<212> PRT
<213> Simian Immunodeficiency Virus

<400> 160			
Asn Asn Thr Asp Lys Ile Asn Leu Thr Ala Pro Gly Gly Gly Asp Pro			
1 5 10 15			
Glu Val Thr Phe			
20			

<210> 161
<211> 20
<212> PRT
<213> Simian Immunodeficiency Virus

<400> 161

29/91

Pro Gly Gly Gly Asp Pro Glu Val Thr Phe Met Trp Thr Asn Cys Arg
1 5 10 15
Gly Glu Phe Leu
20

<210> 162
<211> 20
<212> PRT
<213> Simian Immunodeficiency Virus

<400> 162
Met Trp Thr Asn Cys Arg Gly Glu Phe Leu Tyr Cys Lys Met Asn Trp
1 5 10 15
Phe Leu Asn Trp
20

<210> 163
<211> 20
<212> PRT
<213> Simian Immunodeficiency Virus

<400> 163
Tyr Cys Lys Met Asn Trp Phe Leu Asn Trp Val Glu Asp Arg Asn Thr
1 5 10 15
Ala Asn Gln Lys
20

<210> 164
<211> 20
<212> PRT
<213> Simian Immunodeficiency Virus

<400> 164
Val Glu Asp Arg Asn Thr Ala Asn Gln Lys Pro Lys Glu Gln His Lys
1 5 10 15
Arg Asn Tyr Val
20

<210> 165
<211> 20
<212> PRT
<213> Simian Immunodeficiency Virus

<400> 165
Pro Lys Glu Gln His Lys Arg Asn Tyr Val Pro Cys His Ile Arg Gln
1 5 10 15
Ile Ile Asn Thr
20

<210> 166
<211> 20
<212> PRT
<213> Simian Immunodeficiency Virus

<400> 166
Pro Cys His Ile Arg Gln Ile Ile Asn Thr Trp His Lys Val Gly Lys

30/91

1 5 10 15
Asn Val Tyr Leu
20

<210> 167
<211> 20
<212> PRT
<213> Simian Immunodeficiency Virus

<400> 167
Trp His Lys Val Gly Lys Asn Val Tyr Leu Pro Pro Arg Glu Gly Asp
1 5 10 15
Leu Thr Cys Asn
20

<210> 168
<211> 20
<212> PRT
<213> Simian Immunodeficiency Virus

<400> 168
Pro Pro Arg Glu Gly Asp Leu Thr Cys Asn Ser Thr Val Thr Ser Leu
1 5 10 15
Ile Ala Asn Ile
20

<210> 169
<211> 20
<212> PRT
<213> Simian Immunodeficiency Virus

<400> 169
Ser Thr Val Thr Ser Leu Ile Ala Asn Ile Asp Trp Ile Asp Gly Asn
1 5 10 15
Gln Thr Asn Ile
20

<210> 170
<211> 20
<212> PRT
<213> Simian Immunodeficiency Virus

<400> 170
Asp Trp Ile Asp Gly Asn Gln Thr Asn Ile Thr Met Ser Ala Glu Val
1 5 10 15
Ala Glu Leu Tyr
20

<210> 171
<211> 20
<212> PRT
<213> Simian Immunodeficiency Virus

<400> 171
Thr Met Ser Ala Glu Val Ala Glu Leu Tyr Arg Leu Glu Leu Gly Asp

31/91

1 5 10 15
Tyr Lys Leu Val
20

<210> 172
<211> 20
<212> PRT
<213> Simian Immunodeficiency Virus

<400> 172
Arg Leu Glu Leu Gly Asp Tyr Lys Leu Val Glu Ile Thr Pro Ile Gly
1 5 10 15
Leu Ala Pro Thr
20

<210> 173
<211> 20
<212> PRT
<213> Simian Immunodeficiency Virus

<400> 173
Glu Ile Thr Pro Ile Gly Leu Ala Pro Thr Asp Val Lys Arg Tyr Thr
1 5 10 15
Thr Gly Gly Thr
20

<210> 174
<211> 20
<212> PRT
<213> Simian Immunodeficiency Virus

<400> 174
Asp Val Lys Arg Tyr Thr Thr Gly Gly Thr Ser Arg Asn Lys Arg Gly
1 5 10 15
Val Phe Val Leu
20

<210> 175
<211> 20
<212> PRT
<213> Simian Immunodeficiency Virus

<400> 175
Ser Arg Asn Lys Arg Gly Val Phe Val Leu Gly Phe Leu Gly Phe Leu
1 5 10 15
Ala Thr Ala Gly
20

<210> 176
<211> 20
<212> PRT
<213> Simian Immunodeficiency Virus

<400> 176
Gly Phe Leu Gly Phe Leu Ala Thr Ala Gly Ser Ala Met Gly Ala Ala
1 5 10 15

Ser Leu Thr Leu
20

<210> 177
<211> 20
<212> PRT
<213> Simian Immunodeficiency Virus

<400> 177
Ser Ala Met Gly Ala Ala Ser Leu Thr Leu Thr Ala Gln Ser Arg Thr
1 5 10 15
Leu Leu Ala Gly
20

<210> 178
<211> 20
<212> PRT
<213> Simian Immunodeficiency Virus

<400> 178
Thr Ala Gln Ser Arg Thr Leu Leu Ala Gly Ile Val Gln Gln Gln Gln
1 5 10 15
Gln Leu Leu Asp
20

<210> 179
<211> 20
<212> PRT
<213> Simian Immunodeficiency Virus

<400> 179
Ile Val Gln Gln Gln Gln Gln Leu Leu Asp Val Val Lys Arg Gln Gln
1 5 10 15
Glu Leu Leu Arg
20

<210> 180
<211> 20
<212> PRT
<213> Simian Immunodeficiency Virus

<400> 180
Val Val Lys Arg Gln Gln Glu Leu Leu Arg Leu Thr Val Trp Gly Thr
1 5 10 15
Lys Asn Leu Gln
20

<210> 181
<211> 20
<212> PRT
<213> Simian Immunodeficiency Virus

<400> 181
Leu Thr Val Trp Gly Thr Lys Asn Leu Gln Thr Arg Val Thr Ala Ile
1 5 10 15
Glu Lys Tyr Leu -

20

<210> 182
<211> 20
<212> PRT
<213> Simian Immunodeficiency Virus

<400> 182
Thr Arg Val Thr Ala Ile Glu Lys Tyr Leu Lys Asp Gln Ala Gln Leu
1 5 10 15
Asn Ala Trp Gly
20

<210> 183
<211> 20
<212> PRT
<213> Simian Immunodeficiency Virus

<400> 183
Lys Asp Gln Ala Gln Leu Asn Ala Trp Gly Cys Ala Phe Arg Gln Val
1 5 10 15
Cys His Thr Thr
20

<210> 184
<211> 20
<212> PRT
<213> Simian Immunodeficiency Virus

<400> 184
Cys Ala Phe Arg Gln Val Cys His Thr Thr Val Pro Trp Pro Asn Ala
1 5 10 15
Ser Leu Thr Pro
20

<210> 185
<211> 20
<212> PRT
<213> Simian Immunodeficiency Virus

<400> 185
Val Pro Trp Pro Asn Ala Ser Leu Thr Pro Lys Trp Asn Asn Glu Thr
1 5 10 15
Trp Gln Glu Trp
20

<210> 186
<211> 20
<212> PRT
<213> Simian Immunodeficiency Virus

<400> 186
Lys Trp Asn Asn Glu Thr Trp Gln Glu Trp Glu Arg Lys Val Asp Phe
1 5 10 15
Leu Glu Glu Asn
20

<210> 187
<211> 20
<212> PRT
<213> Simian Immunodeficiency Virus

<400> 187
Glu Arg Lys Val Asp Phe Leu Glu Glu Asn Ile Thr Ala Leu Leu Glu
1 5 10 15
Glu Ala Gln Ile
20

<210> 188
<211> 20
<212> PRT
<213> Simian Immunodeficiency Virus

<400> 188
Ile Thr Ala Leu Leu Glu Glu Ala Gln Ile Gln Gln Glu Lys Asn Met
1 5 10 15
Tyr Glu Leu Gln
20

<210> 189
<211> 20
<212> PRT
<213> Simian Immunodeficiency Virus

<400> 189
Gln Gln Glu Lys Asn Met Tyr Glu Leu Gln Lys Leu Asn Ser Trp Asp
1 5 10 15
Val Phe Gly Asn
20

<210> 190
<211> 20
<212> PRT
<213> Simian Immunodeficiency Virus

<400> 190
Lys Leu Asn Ser Trp Asp Val Phe Gly Asn Trp Phe Asp Leu Ala Ser
1 5 10 15
Trp Ile Lys Tyr
20

<210> 191
<211> 20
<212> PRT
<213> Simian Immunodeficiency Virus

<400> 191
Trp Phe Asp Leu Ala Ser Trp Ile Lys Tyr Ile Gln Tyr Gly Val Tyr
1 5 10 15
Ile Val Val Gly
20

<210> 192
<211> 20
<212> PRT
<213> Simian Immunodeficiency Virus

<400> 192
Ile Gln Tyr Gly Val Tyr Ile Val Val Gly Val Ile Leu Leu Arg Ile
1 5 10 15
Val Ile Tyr Ile
20

<210> 193
<211> 20
<212> PRT
<213> Simian Immunodeficiency Virus

<400> 193
Val Ile Leu Leu Arg Ile Val Ile Tyr Ile Val Gln Met Leu Ala Lys
1 5 10 15
Leu Arg Gln Gly
20

<210> 194
<211> 20
<212> PRT
<213> Simian Immunodeficiency Virus

<400> 194
Val Gln Met Leu Ala Lys Leu Arg Gln Gly Tyr Arg Pro Val Phe Ser
1 5 10 15
Ser Pro Pro Ser
20

<210> 195
<211> 20
<212> PRT
<213> Simian Immunodeficiency Virus

<400> 195
Tyr Arg Pro Val Phe Ser Ser Pro Pro Ser Tyr Phe Gln Gln Thr His
1 5 10 15
Ile Gln Gln Asp
20

<210> 196
<211> 20
<212> PRT
<213> Simian Immunodeficiency Virus

<400> 196
Tyr Phe Gln Gln Thr His Ile Gln Gln Asp Pro Ala Leu Pro Thr Arg
1 5 10 15
Glu Gly Lys Glu
20

<210> 197
<211> 20
<212> PRT
<213> Simian Immunodeficiency Virus

<400> 197
Pro Ala Leu Pro Thr Arg Glu Gly Lys Glu Arg Asp Gly Gly Glu Gly
1 5 10 15
Gly Gly Asn Ser
20

<210> 198
<211> 20
<212> PRT
<213> Simian Immunodeficiency Virus

<400> 198
Arg Asp Gly Gly Glu Gly Gly Gly Asn Ser Ser Trp Pro Trp Gln Ile
1 5 10 15
Glu Tyr Ile His
20

<210> 199
<211> 20
<212> PRT
<213> Simian Immunodeficiency Virus

<400> 199
Ser Trp Pro Trp Gln Ile Glu Tyr Ile His Phe Leu Ile Arg Gln Leu
1 5 10 15
Ile Arg Leu Leu
20

<210> 200
<211> 20
<212> PRT
<213> Simian Immunodeficiency Virus

<400> 200
Phe Leu Ile Arg Gln Leu Ile Arg Leu Leu Thr Trp Leu Phe Ser Asn
1 5 10 15
Cys Arg Thr Leu
20

<210> 201
<211> 20
<212> PRT
<213> Simian Immunodeficiency Virus

<400> 201
Thr Trp Leu Phe Ser Asn Cys Arg Thr Leu Leu Ser Arg Val Tyr Gln
1 5 10 15
Ile Leu Gln Pro
20

<210> 202

<211> 20
<212> PRT
<213> Simian Immunodeficiency Virus

<400> 202
Leu Ser Arg Val Tyr Gln Ile Leu Gln Pro Ile Leu Gln Arg Leu Ser
1 5 10 15
Ala Thr Leu Gln
20

<210> 203
<211> 20
<212> PRT
<213> Simian Immunodeficiency Virus

<400> 203
Ile Leu Gln Arg Leu Ser Ala Thr Leu Gln Arg Ile Arg Glu Val Leu
1 5 10 15
Arg Thr Glu Leu
20

<210> 204
<211> 20
<212> PRT
<213> Simian Immunodeficiency Virus

<400> 204
Arg Ile Arg Glu Val Leu Arg Thr Glu Leu Thr Tyr Leu Gln Tyr Gly
1 5 10 15
Trp Ser Tyr Phe
20

<210> 205
<211> 20
<212> PRT
<213> Simian Immunodeficiency Virus

<400> 205
Thr Tyr Leu Gln Tyr Gly Trp Ser Tyr Phe His Glu Ala Val Gln Ala
1 5 10 15
Val Trp Arg Ser
20

<210> 206
<211> 20
<212> PRT
<213> Simian Immunodeficiency Virus

<400> 206
His Glu Ala Val Gln Ala Val Trp Arg Ser Ala Thr Glu Thr Leu Ala
1 5 10 15
Gly Ala Trp Gly
20

<210> 207
<211> 9

<212> PRT

<213> Human Immunodeficiency Virus

<400> 207

Ala Met Gln Met Leu Lys Glu Thr Ile
 1 5

<210> 208

<211> 9

<212> PRT

<213> Human Immunodeficiency Virus

<400> 208

Gly Pro Gly Gln Ala Phe Tyr Ala Thr
 1 5

<210> 209

<211> 764

<212> PRT

<213> Bacillus anthracis

<400> 209

Met Lys Lys Arg Lys Val Leu Ile Pro Leu Met Ala Leu Ser Thr Ile
 1 5 10 15
 Leu Val Ser Ser Thr Gly Asn Leu Glu Val Ile Gln Ala Glu Val Lys
 20 25 30
 Gln Glu Asn Arg Leu Leu Asn Glu Ser Glu Ser Ser Ser Gln Gly Leu
 35 40 45
 Leu Gly Tyr Tyr Phe Ser Asp Leu Asn Phe Gln Ala Pro Met Val Val
 50 55 60
 Thr Ser Ser Thr Thr Gly Asp Leu Ser Ile Pro Ser Ser Glu Leu Glu
 65 70 75 80
 Asn Ile Pro Ser Glu Asn Gln Tyr Phe Gln Ser Ala Ile Trp Ser Gly
 85 90 95
 Phe Ile Lys Val Lys Lys Ser Asp Glu Tyr Thr Phe Ala Thr Ser Ala
 100 105 110
 Asp Asn His Val Thr Met Trp Val Asp Asp Gln Glu Val Ile Asn Lys
 115 120 125
 Ala Ser Asn Ser Asn Lys Ile Arg Leu Glu Lys Gly Arg Leu Tyr Gln
 130 135 140
 Ile Lys Ile Gln Tyr Gln Arg Glu Asn Pro Thr Glu Lys Gly Leu Asp
 145 150 155 160
 Phe Lys Leu Tyr Trp Thr Asp Ser Gln Asn Lys Lys Glu Val Ile Ser
 165 170 175
 Ser Asp Asn Leu Gln Leu Pro Glu Leu Lys Gln Lys Ser Ser Asn Ser
 180 185 190
 Arg Lys Lys Arg Ser Thr Ser Ala Gly Pro Thr Val Pro Asp Arg Asp
 195 200 205
 Asn Asp Gly Ile Pro Asp Ser Leu Glu Val Glu Gly Tyr Thr Val Asp
 210 215 220
 Val Lys Asn Lys Arg Thr Phe Leu Ser Pro Trp Ile Ser Asn Ile His
 225 230 235 240
 Glu Lys Lys Gly Leu Thr Lys Tyr Lys Ser Ser Pro Glu Lys Trp Ser
 245 250 255
 Thr Ala Ser Asp Pro Tyr Ser Asp Phe Glu Lys Val Thr Gly Arg Ile
 260 265 270
 Asp Lys Asn Val Ser Pro Glu Ala Arg His Pro Leu Val Ala Ala Tyr
 275 280 285

<210> 210
 <211> 588
 <212> PRT
 <213> Ebola virus

<220>
 <221> VARIANT
 <222> 120
 <223> Xaa = Any Amino Acid

<400> 210
 His Gly Phe Arg Phe Glu Val Lys Lys Arg Asp Gly Val Lys Arg Leu
 1 5 10 15
 Glu Glu Leu Leu Pro Ala Val Ser Ser Gly Lys Asn Ile Lys Arg Thr
 20 25 30
 Leu Ala Ala Met Pro Glu Glu Glu Thr Thr Glu Ala Asn Ala Gly Gln
 35 40 45
 Phe Leu Ser Phe Ala Ser Leu Phe Leu Pro Lys Leu Val Val Gly Glu
 50 55 60
 Lys Ala Cys Leu Glu Lys Val Gln Arg Gln Ile Gln Val His Ala Glu
 65 70 75 80
 Gln Gly Leu Ile Gln Tyr Pro Thr Ala Trp Gln Ser Val Gly His Met
 85 90 95
 Met Val Ile Phe Arg Leu Met Arg Thr Asn Phe Leu Ile Lys Phe Leu
 100 105 110
 Leu Ile His Gln Gly Met His Xaa Val Ala Gly His Asp Ala Asn Asp
 115 120 125
 Ala Val Ile Ser Asn Ser Val Ala Gln Ala Arg Phe Ser Gly Leu Leu
 130 135 140
 Ile Val Lys Thr Val Leu Asp His Ile Leu Gln Lys Thr Glu Arg Gly
 145 150 155 160
 Val Arg Leu His Pro Leu Ala Arg Thr Ala Lys Val Lys Asn Glu Val
 165 170 175
 Asn Ser Phe Lys Ala Ala Leu Ser Ser Leu Ala Lys His Gly Glu Tyr
 180 185 190
 Ala Pro Phe Ala Arg Leu Leu Asn Leu Ser Gly Val Asn Asn Leu Glu
 195 200 205
 His Gly Leu Phe Pro Gln Leu Ser Ala Ile Ala Leu Gly Val Ala Thr
 210 215 220
 Ala His Gly Ser Thr Leu Ala Gly Val Asn Val Gly Glu Gln Tyr Gln
 225 230 235 240
 Gln Leu Arg Glu Ala Ala Thr Glu Ala Glu Lys Gln Leu Gln Gln Tyr
 245 250 255
 Ala Glu Ser Arg Glu Leu Asp His Leu Gly Leu Asp Asp Gln Glu Lys
 260 265 270
 Lys Ile Leu Met Asn Phe His Gln Lys Lys Asn Glu Ile Ser Phe Gln
 275 280 285
 Gln Thr Asn Ala Met Val Thr Leu Arg Lys Glu Arg Leu Ala Lys Leu
 290 295 300
 Thr Glu Ala Ile Thr Ala Ala Ser Leu Pro Lys Thr Ser Gly His Tyr
 305 310 315 320
 Asp Asp Asp Asp Asp Ile Pro Phe Pro Gly Pro Ile Asn Asp Asp Asp
 325 330 335
 Asn Pro Gly His Gln Asp Asp Asp Pro Thr Asp Ser Gln Asp Thr Thr
 340 345 350
 Ile Pro Asp Val Val Val Asp Pro Asp Asp Gly Ser Tyr Gly Glu Tyr
 355 360 365
 Gln Ser Tyr Ser Glu Asn Gly Met Asn Ala Pro Asp Asp Leu Val Leu
 370 375 380

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Phe Asp Leu Asp Glu Asp Asp Glu Asp Thr Lys Pro Val Pro Asn Arg
385                      390                      395                      400
Ser Thr Lys Gly Gly Gln Gln Lys Asn Ser Gln Lys Gly Gln His Thr
                      405                      410                      415
Glu Gly Arg Gln Thr Gln Ser Arg Pro Thr Gln Asn Val Pro Gly Pro
                      420                      425                      430
His Arg Thr Ile His His Ala Ser Ala Pro Leu Thr Asp Asn Asp Arg
                      435                      440                      445
Arg Asn Glu Pro Ser Gly Ser Thr Ser Pro Arg Met Leu Thr Pro Ile
                      450                      455                      460
Asn Glu Glu Ala Asp Pro Leu Asp Asp Ala Asp Asp Glu Thr Ser Ser
465                      470                      475                      480
Leu Pro Pro Leu Glu Ser Asp Asp Glu Glu Gln Asp Arg Gly Gly Thr
                      485                      490                      495
Ser Asn Arg Thr Pro Thr Val Ala Pro Pro Ala Pro Val Tyr Arg Asp
                      500                      505                      510
His Ser Glu Lys Lys Glu Leu Pro Gln Asp Glu Arg Gln Asp Gln Asp
                      515                      520                      525
His Thr Gln Glu Ala Arg Asn Gln Asp Ser Asp Asn Thr Gln Pro Glu
                      530                      535                      540
His Ser Phe Glu Glu Met Tyr Arg His Ile Leu Arg Ser Gln Gly Pro
545                      550                      555                      560
Phe Asp Ala Val Leu Tyr Tyr His Met Met Lys Asp Glu Pro Val Val
                      565                      570                      575
Phe Ser Thr Ser Asp Gly Lys Glu Tyr Thr Tyr Pro
                      580                      585

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<210> 211

<211> 2280

<212> PRT

<213> Hepatitis C Virus

<400> 211

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Met Ser Thr Asn Pro Lys Pro Gln Arg Lys Thr Lys Arg Asn Thr Tyr
1                      5                      10                      15
Arg Arg Pro Gln Asp Val Lys Phe Pro Gly Gly Gly Gln Ile Val Gly
                      20                      25                      30
Gly Val Tyr Val Leu Pro Arg Arg Gly Pro Thr Leu Gly Val Arg Ala
                      35                      40                      45
Thr Arg Lys Thr Ser Glu Arg Ser Gln Pro Arg Gly Arg Arg Gln Pro
50                      55                      60
Ile Pro Lys Ala Arg Arg Pro Glu Gly Arg Ala Trp Ala Gln Pro Gly
65                      70                      75                      80
Tyr Pro Trp Pro Leu Tyr Gly Asn Glu Gly Leu Gly Trp Ala Gly Trp
                      85                      90                      95
Leu Leu Ser Pro Arg Gly Ser Arg Pro Ser Trp Gly Pro Thr Asp Pro
100                      105                      110
Arg Arg Arg Ser Arg Asn Leu Gly Lys Val Ile Asp Thr Leu Thr Cys
115                      120                      125
Gly Phe Ala Asp Leu Met Gly Tyr Ile Pro Leu Val Gly Ala Pro Leu
130                      135                      140
Gly Gly Ala Ala Arg Ala Leu Ala His Gly Val Arg Val Leu Glu Asp
145                      150                      155                      160

Gly Val Asn Tyr Ala Thr Gly Asn Leu Pro Gly Cys Ser Phe Ser Ile
165                      170                      175
Phe Leu Leu Ala Leu Leu Ser Cys Leu Thr Ile Pro Ala Ser Ala Tyr
180                      185                      190
Gln Val Arg Asn Ala Ser Gly Leu Tyr His Val Thr Asn Asp Cys Ser
195                      200                      205

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Asn	Ser	Ser	Ile	Val	Tyr	Glu	Ala	Ala	Gly	Met	Ile	Met	His	Thr	Pro
210						215					220				
Gly	Cys	Val	Pro	Cys	Val	Arg	Glu	Asn	Asn	Ala	Ser	Arg	Cys	Trp	Val
225					230				235						240
Ala	Leu	Thr	Pro	Thr	Leu	Ala	Ala	Arg	Asn	Thr	Ser	Ile	Pro	Thr	Thr
				245					250					255	
Thr	Ile	Arg	Arg	His	Val	Asp	Leu	Leu	Val	Gly	Ala	Ala	Ala	Phe	Cys
				260					265				270		
Ser	Ala	Met	Tyr	Val	Gly	Asp	Leu	Cys	Gly	Ser	Val	Phe	Leu	Val	Ser
		275					280					285			
Gln	Leu	Phe	Thr	Phe	Ser	Pro	Arg	Arg	Tyr	Glu	Thr	Val	Gln	Asp	Cys
290						295					300				
Asn	Cys	Ser	Ile	Tyr	Pro	Gly	His	Val	Ser	Gly	His	Arg	Met	Ala	Trp
305					310					315					320
Asp	Met	Met	Met	Asn	Trp	Ser	Pro	Thr	Thr	Ala	Leu	Val	Val	Ser	Gln
				325					330					335	
Leu	Leu	Arg	Ile	Pro	Gln	Ala	Val	Val	Asp	Met	Val	Ala	Gly	Ala	His
			340					345					350		
Trp	Gly	Val	Leu	Ala	Gly	Leu	Ala	Tyr	Tyr	Ser	Met	Val	Gly	Asn	Trp
		355					360					365			
Ala	Lys	Val	Leu	Ile	Val	Met	Leu	Leu	Phe	Ala	Gly	Val	Asp	Gly	Val
370						375					380				
Thr	Tyr	Thr	Thr	Gly	Gly	Ser	Gln	Ala	Arg	His	Thr	Gln	Ser	Val	Thr
385					390					395					400
Ser	Phe	Phe	Thr	Gln	Gly	Pro	Ala	Gln	Arg	Ile	Gln	Leu	Ile	Asn	Thr
				405					410					415	
Asn	Gly	Ser	Trp	His	Ile	Asn	Arg	Thr	Ala	Leu	Asn	Cys	Asn	Glu	Ser
			420					425					430		
Leu	Asn	Thr	Gly	Phe	Phe	Ala	Ala	Leu	Phe	Tyr	Ala	His	Lys	Phe	Asn
		435					440					445			
Ser	Ser	Gly	Cys	Pro	Glu	Arg	Met	Ala	Ser	Cys	Ser	Ser	Ile	Asp	Lys
		450				455					460				
Phe	Ala	Gln	Gly	Trp	Gly	Pro	Ile	Thr	Tyr	Thr	Glu	Pro	Arg	Asp	Leu
465					470					475					480
Asp	Gln	Arg	Pro	Tyr	Cys	Trp	His	Tyr	Ala	Pro	Arg	Gln	Cys	Gly	Ile
				485					490					495	
Val	Pro	Ala	Ser	Gln	Val	Cys	Gly	Pro	Val	Tyr	Cys	Phe	Thr	Pro	Ser
				500					505					510	
Pro	Val	Val	Val	Gly	Thr	Thr	Asp	Arg	Ser	Gly	Ala	Pro	Thr	Tyr	Asn
		515					520					525			
Trp	Gly	Ala	Asn	Glu	Thr	Asp	Val	Leu	Leu	Leu	Asn	Asn	Thr	Arg	Pro
	530					535					540				
Pro	Gln	Gly	Asn	Trp	Phe	Gly	Cys	Thr	Trp	Met	Asn	Ser	Thr	Gly	Phe
545					550					555					560
Thr	Lys	Thr	Cys	Gly	Gly	Pro	Pro	Cys	Asn	Ile	Gly	Gly	Val	Gly	Asn
				565					570					575	
Leu	Thr	Leu	Thr	Cys	Pro	Thr	Asp	Cys	Phe	Arg	Lys	His	Pro	Glu	Ala
			580					585					590		
Thr	Tyr	Thr	Lys	Cys	Gly	Ser	Gly	Pro	Trp	Leu	Thr	Pro	Arg	Cys	Ile
		595					600					605			
Val	Asp	Tyr	Pro	Tyr	Arg	Leu	Trp	His	Tyr	Pro	Cys	Thr	Val	Asn	Phe
	610					615					620				
Thr	Ile	Phe	Lys	Val	Arg	Met	Tyr	Val	Gly	Gly	Val	Glu	His	Arg	Leu
625					630					635					640
Ser	Ala	Ala	Cys	Asn	Trp	Thr	Arg	Gly	Glu	Arg	Cys	Asp	Leu	Glu	Asp
				645					650					655	
Arg	Asp	Arg	Ser	Glu	Leu	Ser	Pro	Leu	Leu	Leu	Ser	Thr	Thr	Glu	Trp
			660					665					670		
Gln	Thr	Leu	Pro	Cys	Ser	Phe	Thr	Thr	Leu	Pro	Ala	Leu	Ser	Thr	Gly
		675					680					685			

Leu	Ile	His	Leu	His	Gln	Asn	Ile	Val	Asp	Val	Gln	Tyr	Leu	Tyr	Gly	690	695	700
Ile	Gly	Ser	Ala	Val	Val	Ser	Phe	Val	Ile	Lys	Trp	Glu	Tyr	Ile	Val	705	710	715
Leu	Leu	Phe	Leu	Leu	Leu	Ala	Asp	Ala	Arg	Val	Cys	Ala	Cys	Leu	Trp	725	730	735
Met	Met	Leu	Leu	Ile	Ala	Gln	Ala	Glu	Ala	Ala	Leu	Glu	Asn	Leu	Val	740	745	750
Val	Leu	Asn	Ala	Ala	Ser	Leu	Ala	Gly	Ala	Asp	Gly	Ile	Leu	Ser	Phe	755	760	765
Leu	Val	Phe	Phe	Cys	Ala	Ala	Trp	Tyr	Ile	Lys	Gly	Arg	Leu	Val	Pro	770	775	780
Gly	Ala	Ala	Tyr	Ala	Leu	Tyr	Gly	Val	Trp	Pro	Leu	Leu	Leu	Leu	Leu	785	790	795
Leu	Ala	Leu	Pro	Pro	Arg	Ala	Tyr	Ala	Met	Asp	Arg	Glu	Met	Ala	Ala	805	810	815
Ser	Cys	Gly	Gly	Val	Val	Phe	Val	Gly	Leu	Ile	Leu	Leu	Thr	Leu	Ser	820	825	830
Pro	His	Tyr	Lys	Val	Phe	Leu	Ala	Arg	Leu	Ile	Trp	Trp	Leu	Gln	Tyr	835	840	845
Phe	Ile	Thr	Arg	Ala	Glu	Ala	His	Leu	Cys	Val	Trp	Val	Pro	Pro	Leu	850	855	860
Asn	Val	Arg	Gly	Gly	Arg	Asp	Ala	Ile	Ile	Leu	Leu	Thr	Cys	Ala	Ala	865	870	875
His	Pro	Glu	Leu	Ile	Phe	Asp	Ile	Thr	Lys	Leu	Leu	Leu	Ala	Ile	Leu	885	890	895
Gly	Pro	Leu	Met	Val	Leu	Gln	Ala	Ala	Ile	Thr	Ala	Met	Pro	Tyr	Phe	900	905	910
Val	Arg	Ala	Gln	Gly	Leu	Ile	Arg	Ala	Cys	Met	Leu	Val	Arg	Lys	Val	915	920	925
Ala	Gly	Gly	His	Tyr	Val	Gln	Met	Ala	Phe	Met	Lys	Leu	Ala	Ala	Leu	930	935	940
Thr	Gly	Thr	Tyr	Val	Tyr	Asp	His	Leu	Thr	Pro	Leu	Gln	Asp	Trp	Ala	945	950	955
His	Ala	Gly	Leu	Arg	Asp	Leu	Ala	Val	Ala	Val	Glu	Pro	Val	Val	Phe	965	970	975
Ser	Asp	Met	Glu	Thr	Lys	Ile	Ile	Thr	Trp	Gly	Ala	Asp	Thr	Ala	Ala	980	985	990
Cys	Gly	Asp	Ile	Ile	Leu	Gly	Leu	Pro	Val	Ser	Ala	Arg	Arg	Gly	Arg	995	1000	1005
Glu	Ile	Leu	Leu	Gly	Pro	Ala	Asp	Ser	Ile	Glu	Gly	Gln	Gly	Trp	Arg	1010	1015	1020
Leu	Leu	Ala	Pro	Ile	Thr	Ala	Tyr	Ala	Gln	Gln	Thr	Arg	Gly	Leu	Leu	1025	1030	1035
Gly	Cys	Ile	Val	Thr	Ser	Leu	Thr	Gly	Arg	Asp	Lys	Asn	Gln	Val	Glu	1045	1050	1055
Gly	Glu	Val	Gln	Val	Val	Ser	Thr	Ala	Thr	Gln	Ser	Phe	Leu	Ala	Thr	1060	1065	1070
Cys	Val	Asn	Gly	Val	Cys	Trp	Thr	Val	Phe	His	Gly	Ala	Gly	Ser	Lys	1075	1080	1085
Thr	Leu	Ala	Gly	Pro	Lys	Gly	Pro	Ile	Thr	Gln	Met	Tyr	Thr	Asn	Val	1090	1095	1100
Asp	Gln	Asp	Leu	Val	Gly	Trp	His	Ala	Pro	Pro	Gly	Ala	Arg	Ser	Leu	1105	1110	1115
Thr	Pro	Cys	Thr	Cys	Gly	Ser	Ser	Asp	Leu	Tyr	Leu	Val	Thr	Arg	His	1125	1130	1135
Ala	Asp	Val	Ile	Pro	Val	Arg	Arg	Arg	Gly	Asp	Gly	Arg	Gly	Ser	Leu	1140	1145	1150
Leu	Ser	Pro	Arg	Pro	Val	Ser	Tyr	Leu	Lys	Gly	Ser	Ser	Gly	Gly	Pro	1155	1160	1165
Leu	Leu	Cys	Pro	Ser	Gly	His	Ala	Val	Gly	Ile	Phe	Arg	Ala	Ala	Val			

1170	1175	1180
Cys Thr Arg Gly Val	Ala Lys Ala Val	Asp Phe Ile Pro Val Glu Ser
1185	1190	1195
Met Glu Thr Thr	Met Arg Ser Pro Val	Phe Thr Asp Asn Ser Ser Pro
	1205	1210
Pro Ala Val	Pro Gln Thr Phe Gln Val	Ala His Leu His Ala Pro Thr
	1220	1225
Gly Ser Gly Lys Ser Thr	Lys Val Pro Ala Ala Tyr	Ala Ala Gln Gly
	1235	1240
Tyr Lys Val Leu Val	Leu Asn Pro Ser Val	Ala Ala Thr Leu Gly Phe
	1250	1255
Gly Ala Tyr Met Ser	Lys Ala His Gly Thr	Asp Pro Asn Ile Arg Thr
1265	1270	1275
Gly Val Arg Thr	Ile Thr Thr Gly Ala Pro	Ile Thr Tyr Ser Thr Tyr
	1285	1290
Gly Lys Phe Leu Ala	Asp Gly Gly Cys Ser Gly Gly	Ala Tyr Asp Ile
	1300	1305
Ile Ile Cys Asp Glu	Cys His Ser Thr Asp Ser Thr	Thr Ile Leu Gly
	1315	1320
Ile Gly Thr Val	Leu Asp Gln Ala Glu Thr	Ala Gly Ala Arg Leu Val
	1330	1335
Val Leu Ala Thr	Ala Thr Pro Pro Gly Ser	Val Thr Val Pro His Pro
1345	1350	1355
Asn Ile Glu Glu	Val Ala Leu Ser Asn Thr	Gly Glu Ile Pro Phe Tyr
	1365	1370
Gly Lys Ala Ile	Pro Leu Glu Ala Ile Lys	Gly Gly Arg His Leu Ile
	1380	1385
Phe Cys His Ser	Lys Lys Lys Cys Asp Glu	Leu Ala Ala Lys Leu Ser
	1395	1400
Gly Leu Gly Ile	Asn Ala Val Ala Tyr Tyr	Arg Gly Leu Asp Val Ser
	1410	1415
Val Ile Pro Thr	Ser Gly Asp Val Val Ile	Val Ala Thr Asp Ala Leu
1425	1430	1435
Met Thr Gly Tyr	Thr Gly Asp Phe Asp Ser	Val Ile Asp Cys Asn Thr
	1445	1450
Cys Val Thr	Gln Thr Val Asp Phe Ser	Leu Asp Pro Thr Phe Thr Ile
	1460	1465
Glu Thr Thr	Thr Val Pro Gln Asp Ala	Val Ser Arg Ser Gln Arg Arg
	1475	1480
Gly Arg Thr	Gly Arg Gly Gly Ile Tyr	Arg Phe Val Thr Pro
	1490	1495
Gly Glu Arg Pro	Ser Gly Met Phe Asp Ser	Ser Val Leu Cys Glu Cys
1505	1510	1515
Tyr Asp Ala	Gly Cys Ala Trp Tyr Glu	Leu Thr Pro Ala Glu Thr Thr
	1525	1530
Val Arg Leu	Arg Ala Tyr Leu Asn Thr	Pro Gly Leu Pro Val Cys Gln
	1540	1545
Asp His Leu	Glu Phe Trp Glu Ser Val	Phe Thr Gly Leu Thr His Ile
	1555	1560
Asp Ala His	Phe Leu Ser Gln Thr Lys	Gln Ala Gly Asp Asn Phe Pro
	1570	1575
Tyr Leu Val	Ala Tyr Gln Ala Thr Val	Cys Ala Arg Ala Gln Ala Pro
1585	1590	1595
Pro Pro Ser	Trp Asp Gln Met Trp Lys	Cys Leu Ile Arg Leu Lys Pro
	1605	1610
Thr Leu His	Gly Pro Thr Pro Leu Leu	Tyr Arg Leu Gly Ala Val Gln
	1620	1625
Asn Glu Ile	Thr Leu Thr His Pro Ile	Thr Lys Phe Ile Met Ala Cys
	1635	1640
Met Ser Ala	Asp Leu Glu Val Val Thr	Ser Thr Trp Val Leu Val Gly
	1650	1655
		1660

Gly Val Leu Ala Ala Leu Ala Ala Tyr Cys Leu Thr Thr Gly Ser Val
 1665 1670 1675 1680
 Val Ile Val Gly Arg Ile Ile Leu Ser Gly Arg Pro Ala Val Val Pro
 1685 1690 1695
 Asp Arg Glu Val Leu Tyr Arg Glu Phe Asp Glu Met Glu Glu Cys Ala
 1700 1705 1710
 Ser His Leu Pro Tyr Ile Glu Gln Gly Met Gln Leu Ala Glu Gln Phe
 1715 1720 1725
 Lys Gln Lys Ala Leu Gly Leu Leu Gln Thr Ala Thr Lys Gln Ala Glu
 1730 1735 1740
 Ala Ala Ala Pro Val Val Glu Ser Arg Trp Arg Ala Leu Glu Ala Phe
 1745 1750 1755 1760
 Trp Ala Lys His Met Trp Asn Phe Ile Ser Gly Ile Gln Tyr Leu Ala
 1765 1770 1775
 Gly Leu Ser Thr Leu Pro Gly Asn Pro Ala Ile Ala Ser Leu Met Ala
 1780 1785 1790
 Phe Thr Ala Ser Ile Thr Ser Pro Leu Thr Thr Gln Asn Thr Leu Leu
 1795 1800 1805
 Phe Asn Ile Leu Gly Gly Trp Val Ala Ala Gln Leu Ala Pro Pro Ser
 1810 1815 1820
 Ala Ala Ser Ala Phe Val Gly Ala Gly Ile Ala Gly Ala Ala Ile Gly
 1825 1830 1835 1840
 Ser Ile Gly Leu Gly Lys Val Leu Val Asp Ile Leu Ala Gly Tyr Gly
 1845 1850 1855
 Ala Gly Val Ala Gly Ala Leu Val Ala Phe Lys Val Met Ser Gly Glu
 1860 1865 1870
 Ala Pro Ser Ala Glu Asp Leu Val Asn Leu Leu Pro Ala Ile Leu Ser
 1875 1880 1885
 Pro Gly Ala Leu Val Val Gly Val Val Cys Ala Ala Ile Leu Arg Arg
 1890 1895 1900
 His Val Gly Pro Gly Glu Gly Ala Val Gln Trp Met Asn Arg Leu Ile
 1905 1910 1915 1920
 Ala Phe Ala Ser Arg Gly Asn His Val Ser Pro Thr His Tyr Val Pro
 1925 1930 1935
 Glu Ser Asp Ala Ala Ala Arg Val Thr Gln Ile Leu Ser Ser Leu Thr
 1940 1945 1950
 Ile Thr Gln Leu Leu Lys Arg Leu His Gln Trp Ile Asn Glu Asp Cys
 1955 1960 1965
 Ser Thr Pro Cys Ser Gly Ser Trp Leu Lys Asp Val Trp Asp Trp Ile
 1970 1975 1980
 Cys Thr Val Leu Thr Asp Phe Lys Thr Trp Leu Gln Ser Lys Leu Leu
 1985 1990 1995 2000
 Pro Lys Leu Pro Gly Val Pro Phe Phe Ser Cys Gln Arg Gly Tyr Lys
 2005 2010 2015
 Gly Val Trp Arg Gly Asp Gly Ile Met Gln Thr Thr Cys Pro Cys Gly
 2020 2025 2030
 Ala Gln Ile Thr Gly His Val Lys Asn Gly Ser Met Arg Ile Val Gly
 2035 2040 2045
 Pro Lys Thr Cys Ser Asn Thr Trp His Gly Thr Phe Pro Ile Asn Ala
 2050 2055 2060
 Tyr Thr Thr Gly Pro Cys Thr Pro Ser Pro Ala Pro Asn Tyr Ser Arg
 2065 2070 2075 2080
 Ala Leu Trp Arg Val Ala Ala Glu Glu Tyr Val Glu Ile Thr Arg Val
 2085 2090 2095
 Gly Asp Phe His Tyr Val Thr Gly Met Thr Thr Asp Asn Val Lys Cys
 2100 2105 2110
 Pro Cys Gln Val Pro Ala Pro Glu Phe Phe Thr Glu Leu Asp Gly Val
 2115 2120 2125
 Arg Leu His Arg Tyr Ala Pro Ala Cys Arg Pro Leu Leu Arg Glu Asp
 2130 2135 2140
 Val Thr Phe Gln Val Gly Leu Asn Gln Tyr Leu Val Gly Ser Gln Leu

Gln	Arg	Leu	Arg	Ile	Val	Arg	Gly	Thr	Gln	Leu	Phe	Glu	Asp	Asn	Tyr
			100,					105					110		
Ala	Leu	Ala	Val	Leu	Asp	Asn	Gly	Asp	Pro	Leu	Asn	Asn	Thr	Thr	Pro
		115					120					125			
Val	Thr	Gly	Ala	Ser	Pro	Gly	Gly	Leu	Arg	Glu	Leu	Gln	Leu	Arg	Ser
		130				135					140				
Leu	Thr	Glu	Ile	Leu	Lys	Gly	Gly	Val	Leu	Ile	Gln	Arg	Asn	Pro	Gln
145					150					155					160
Leu	Cys	Tyr	Gln	Asp	Thr	Ile	Leu	Trp	Lys	Asp	Ile	Phe	His	Lys	Asn
				165					170					175	
Asn	Gln	Leu	Ala	Leu	Thr	Leu	Ile	Asp	Thr	Asn	Arg	Ser	Arg	Ala	Cys
			180					185					190		
His	Pro	Cys	Ser	Pro	Met	Cys	Lys	Gly	Ser	Arg	Cys	Trp	Gly	Glu	Ser
		195					200					205			
Ser	Glu	Asp	Cys	Gln	Ser	Leu	Thr	Arg	Thr	Val	Cys	Ala	Gly	Gly	Cys
		210				215					220				
Ala	Arg	Cys	Lys	Gly	Pro	Leu	Pro	Thr	Asp	Cys	Cys	His	Glu	Gln	Cys
225					230					235					240
Ala	Ala	Gly	Cys	Thr	Gly	Pro	Lys	His	Ser	Asp	Cys	Leu	Ala	Cys	Leu
				245					250					255	
His	Phe	Asn	His	Ser	Gly	Ile	Cys	Glu	Leu	His	Cys	Pro	Ala	Leu	Val
		260						265					270		
Thr	Tyr	Asn	Thr	Asp	Thr	Phe	Glu	Ser	Met	Pro	Asn	Pro	Glu	Gly	Arg
		275					280					285			
Tyr	Thr	Phe	Gly	Ala	Ser	Cys	Val	Thr	Ala	Cys	Pro	Tyr	Asn	Tyr	Leu
		290				295					300				
Ser	Thr	Asp	Val	Gly	Ser	Cys	Thr	Leu	Val	Cys	Pro	Leu	His	Asn	Gln
305				310						315					320
Glu	Val	Thr	Ala	Glu	Asp	Gly	Thr	Gln	Arg	Cys	Glu	Lys	Cys	Ser	Lys
				325				330						335	
Pro	Cys	Ala	Arg	Val	Cys	Tyr	Gly	Leu	Gly	Met	Glu	His	Leu	Arg	Glu
			340					345					350		
Val	Arg	Ala	Val	Thr	Ser	Ala	Asn	Ile	Gln	Glu	Phe	Ala	Gly	Cys	Lys
		355					360					365			
Lys	Ile	Phe	Gly	Ser	Leu	Ala	Phe	Leu	Pro	Glu	Ser	Phe	Asp	Gly	Asp
		370				375					380				
Pro	Ala	Ser	Asn	Thr	Ala	Pro	Leu	Gln	Pro	Glu	Gln	Leu	Gln	Val	Phe
385				390						395					400
Glu	Thr	Leu	Glu	Glu	Ile	Thr	Gly	Tyr	Leu	Tyr	Ile	Ser	Ala	Trp	Pro
				405				410						415	
Asp	Ser	Leu	Pro	Asp	Leu	Ser	Val	Phe	Gln	Asn	Leu	Gln	Val	Ile	Arg
			420					425					430		
Gly	Arg	Ile	Leu	His	Asn	Gly	Ala	Tyr	Ser	Leu	Thr	Leu	Gln	Gly	Leu
			435				440					445			
Gly	Ile	Ser	Trp	Leu	Gly	Leu	Arg	Ser	Leu	Arg	Glu	Leu	Gly	Ser	Gly
		450				455					460				
Leu	Ala	Leu	Ile	His	His	Asn	Thr	His	Leu	Cys	Phe	Val	His	Thr	Val
465					470					475					480
Pro	Trp	Asp	Gln	Leu	Phe	Arg	Asn	Pro	His	Gln	Ala	Leu	Leu	His	Thr
				485				490						495	
Ala	Asn	Arg	Pro	Glu	Asp	Glu	Cys	Val	Gly	Glu	Gly	Leu	Ala	Cys	His
			500					505					510		
Gln	Leu	Cys	Ala	Arg	Gly	His	Cys	Trp	Gly	Pro	Gly	Pro	Thr	Gln	Cys
		515					520						525		
Val	Asn	Cys	Ser	Gln	Phe	Leu	Arg	Gly	Gln	Glu	Cys	Val	Glu	Glu	Cys
		530				535					540				
Arg	Val	Leu	Gln	Gly	Leu	Pro	Arg	Glu	Tyr	Val	Asn	Ala	Arg	His	Cys
545					550					555					560
Leu	Pro	Cys	His	Pro	Glu	Cys	Gln	Pro	Gln	Asn	Gly	Ser	Val	Thr	Cys
				565				570						575	
Phe	Gly	Pro	Glu	Ala	Asp	Gln	Cys	Val	Ala	Cys	Ala	His	Tyr	Lys	Asp

Ser Pro Leu Ala Pro Ser Glu Gly Ala Gly Ser Asp Val Phe Asp Gly
 1075 1080 1085
 Asp Leu Gly Met Gly Ala Ala Lys Gly Leu Gln Ser Leu Pro Thr His
 1090 1095 1100
 Asp Pro Ser Pro Leu Gln Arg Tyr Ser Glu Asp Pro Thr Val Pro Leu
 1105 1110 1115 1120
 Pro Ser Glu Thr Asp Gly Tyr Val Ala Pro Leu Thr Cys Ser Pro Gln
 1125 1130 1135
 Pro Glu Tyr Val Asn Gln Pro Asp Val Arg Pro Gln Pro Pro Ser Pro
 1140 1145 1150
 Arg Glu Gly Pro Leu Pro Ala Ala Arg Pro Ala Gly Ala Thr Leu Glu
 1155 1160 1165
 Arg Pro Lys Thr Leu Ser Pro Gly Lys Asn Gly Val Val Lys Asp Val
 1170 1175 1180
 Phe Ala Phe Gly Gly Ala Val Glu Asn Pro Glu Tyr Leu Thr Pro Gln
 1185 1190 1195 1200
 Gly Gly Ala Ala Pro Gln Pro His Pro Pro Pro Ala Phe Ser Pro Ala
 1205 1210 1215
 Phe Asp Asn Leu Tyr Tyr Trp Asp Gln Asp Pro Pro Glu Arg Gly Ala
 1220 1225 1230
 Pro Pro Ser Thr Phe Lys Gly Thr Pro Thr Ala Glu Asn Pro Glu Tyr
 1235 1240 1245
 Leu Gly Leu Asp Val Pro Val
 1250 1255

<210> 214

<211> 574

<212> PRT

<213> Respiratory Syncytial Virus

<400> 214

Met Glu Leu Leu Ile Leu Lys Ala Asn Ala Ile Thr Thr Ile Leu Thr
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 Tyr Gln Ser Thr Cys Ser Ala Val Ser Lys Gly Tyr Leu Ser Ala Leu
 35 40 45
 Arg Thr Gly Trp Tyr Thr Ser Val Ile Thr Ile Glu Leu Ser Asn Ile
 50 55 60
 Lys Glu Asn Lys Cys Asn Gly Thr Asp Ala Lys Val Lys Leu Ile Lys
 65 70 75 80
 Gln Glu Leu Asp Lys Tyr Lys Asn Ala Val Thr Glu Leu Gln Leu Leu
 85 90 95

Met Gln Ser Thr Pro Pro Thr Asn Asn Arg Ala Arg Arg Glu Leu Pro
 100 105 110
 Arg Phe Met Asn Tyr Thr Leu Asn Asn Ala Lys Lys Thr Asn Val Thr
 115 120 125
 Leu Ser Lys Lys Arg Lys Arg Arg Phe Leu Gly Phe Leu Leu Gly Val
 130 135 140
 Gly Ser Ala Ile Ala Ser Gly Val Ala Val Ser Lys Val Leu His Leu
 145 150 155 160
 Glu Gly Glu Val Asn Lys Ile Lys Ser Ala Leu Leu Ser Thr Asn Lys
 165 170 175
 Ala Val Val Ser Leu Ser Asn Gly Val Ser Val Leu Thr Ser Lys Val
 180 185 190
 Leu Asp Leu Lys Asn Tyr Ile Asp Lys Gln Leu Leu Pro Ile Val Asn
 195 200 205
 Lys Gln Ser Cys Ser Ile Ser Asn Ile Glu Thr Val Ile Glu Phe Gln
 210 215 220

Gln Lys Asn Asn Arg Leu Leu Glu Ile Thr Arg Glu Phe Ser Val Asn
 225 230 235 240
 Ala Gly Val Thr Thr Pro Val Ser Thr Tyr Met Leu Thr Asn Ser Glu
 245 250 255
 Leu Leu Ser Leu Ile Asn Asp Met Pro Ile Thr Asn Asp Gln Lys Lys
 260 265 270
 Leu Met Ser Asn Asn Val Gln Ile Val Arg Gln Gln Ser Tyr Ser Ile
 275 280 285
 Met Ser Ile Ile Lys Glu Glu Val Leu Ala Tyr Val Val Gln Leu Pro
 290 295 300
 Leu Tyr Gly Val Ile Asp Thr Pro Cys Trp Lys Leu His Thr Ser Pro
 305 310 315 320
 Leu Cys Thr Thr Asn Thr Lys Glu Gly Ser Asn Ile Cys Leu Thr Arg
 325 330 335
 Thr Asp Arg Gly Trp Tyr Cys Asp Asn Ala Gly Ser Val Ser Phe Phe
 340 345 350
 Pro Gln Ala Glu Thr Cys Lys Val Gln Ser Asn Arg Val Phe Cys Asp
 355 360 365
 Thr Met Asn Ser Leu Thr Leu Pro Ser Glu Ile Asn Leu Cys Asn Val
 370 375 380
 Asp Ile Phe Asn Pro Lys Tyr Asp Cys Lys Ile Met Thr Ser Lys Thr
 385 390 395 400
 Asp Val Ser Ser Ser Val Ile Thr Ser Leu Gly Ala Ile Val Ser Cys
 405 410 415
 Tyr Gly Lys Thr Lys Cys Thr Ala Ser Asn Lys Asn Arg Gly Ile Ile
 420 425 430
 Lys Thr Phe Ser Asn Gly Cys Asp Tyr Val Ser Asn Lys Gly Met Asp
 435 440 445
 Thr Val Ser Val Gly Asn Thr Leu Tyr Tyr Val Asn Lys Gln Glu Gly
 450 455 460
 Lys Ser Leu Tyr Val Lys Gly Glu Pro Ile Ile Asn Phe Tyr Asp Pro
 465 470 475 480
 Leu Val Phe Pro Ser Asp Glu Phe Asp Ala Ser Ile Ser Gln Val Asn
 485 490 495
 Glu Lys Ile Asn Gln Ser Leu Ala Phe Ile Arg Lys Ser Asp Glu Leu
 500 505 510
 Leu His Asn Val Asn Ala Gly Lys Ser Thr Thr Asn Ile Met Ile Thr
 515 520 525
 Thr Ile Ile Ile Val Ile Ile Val Ile Leu Leu Ser Leu Ile Ala Val
 530 535 540
 Gly Leu Leu Leu Tyr Cys Lys Ala Arg Ser Thr Pro Val Thr Leu Ser
 545 550 555 560
 Lys Asp Gln Leu Ser Gly Ile Asn Asn Ile Ala Phe Ser Asn
 565 570

<210> 215

<211> 151

<212> PRT

<213> Human Immunodeficiency Virus 2

<400> 215

Asp Val Val Lys Arg Gln Gln Glu Leu Leu Arg Leu Thr Val Trp Gly
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 Thr Lys Asn Leu Gln Ala Arg Val Thr Ala Ile Glu Lys Tyr Leu Lys
 20 25 30
 Asp Gln Ala His Val Asn Ser Trp Gly Cys Ala Phe Arg Gln Val Cys
 35 40 45
 His Thr Thr Val Pro Trp Val Asn Asp Thr Leu Thr Pro Asp Trp Asp
 50 55 60

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Asn Met Thr Trp Gln Glu Trp Glu Glu Lys Val Arg Tyr Leu Glu Ala
65          70          75          80
Asn Ile Ser Gln Ser Leu Glu Gln Ala Gln Ile Leu Gln Glu Lys Asn
      85          90          95
Met Tyr Glu Leu Gln Lys Leu Asn Ser Trp Asp Ile Phe Gly Asn Trp
      100        105        110
Phe Asp Leu Thr Ser Trp Val Lys Tyr Ile Gln Tyr Gly Val Cys Ile
      115        120        125
Ile Val Gly Ile Val Ala Leu Arg Ile Val Ile Tyr Val Val Gln Met
      130        135        140
Leu Ser Arg Leu Arg Lys Gly
145          150

```

<210> 216

<211> 522

<212> PRT

<213> Human Immunodeficiency Virus

<400> 216

```

Met Gly Ala Arg Asn Ser Val Leu Arg Gly Lys Lys Ala Asp Glu Leu
1      5      10      15
Glu Arg Ile Arg Leu Arg Pro Gly Gly Lys Lys Lys Tyr Arg Leu Lys
      20      25      30
His Ile Val Trp Ala Ala Asn Lys Leu Asp Arg Phe Gly Leu Ala Glu
      35      40      45
Ser Leu Leu Glu Ser Lys Glu Gly Cys Gln Lys Ile Leu Thr Val Leu
      50      55      60
Asp Pro Met Val Pro Thr Gly Ser Glu Asn Leu Lys Ser Leu Phe Asn
      65      70      75      80
Thr Val Cys Val Ile Trp Cys Ile His Ala Glu Glu Lys Val Lys Asp
      85      90      95
Thr Glu Gly Ala Lys Gln Ile Val Arg Arg His Leu Val Ala Glu Thr
      100     105     110
Gly Thr Ala Glu Lys Met Pro Ser Thr Ser Arg Pro Thr Ala Pro Ser
      115     120     125
Ser Glu Lys Gly Gly Asn Tyr Pro Val Gln His Val Gly Gly Asn Tyr
      130     135     140
Thr His Ile Pro Leu Ser Pro Arg Thr Leu Asn Ala Trp Val Lys Leu
      145     150     155     160
Val Glu Glu Lys Lys Phe Gly Ala Glu Val Val Pro Gly Phe Gln Ala
      165     170     175
Leu Ser Glu Gly Cys Thr Pro Tyr Asp Ile Asn Gln Met Leu Asn Cys
      180     185     190
Val Gly Asp His Gln Ala Ala Met Gln Ile Ile Arg Glu Ile Ile Asn
      195     200     205
Glu Glu Ala Ala Glu Trp Asp Val Gln His Pro Ile Pro Gly Pro Leu
      210     215     220
Pro Ala Gly Gln Leu Arg Glu Pro Arg Gly Ser Asp Ile Ala Gly Thr
      225     230     235     240
Thr Ser Thr Val Glu Glu Gln Ile Gln Trp Met Phe Arg Pro Gln Asn
      245     250     255
Pro Val Pro Val Gly Asn Ile Tyr Arg Arg Trp Ile Gln Ile Gly Leu
      260     265     270
Gln Lys Cys Val Arg Met Tyr Asn Pro Thr Asn Ile Leu Asp Ile Lys
      275     280     285
Gln Gly Pro Lys Glu Pro Phe Gln Ser Tyr Val Asp Arg Phe Tyr Lys
      290     295     300
Ser Leu Arg Ala Glu Gln Thr Asp Pro Ala Val Lys Asn Trp Met Thr
      305     310     315     320
Gln Thr Leu Leu Val Gln Asn Ala Asn Pro Asp Cys Lys Leu Val Leu

```

```

          325          330          335
Lys Gly Leu Gly Met Asn Pro Thr Leu Glu Glu Met Leu Thr Ala Cys
          340          345          350
Gln Gly Val Gly Gly Pro Gly Gln Lys Ala Arg Leu Met Ala Glu Ala
          355          360          365
Leu Lys Glu Val Ile Gly Pro Ala Pro Ile Pro Phe Ala Ala Ala Gln
          370          375          380
Gln Arg Lys Ala Phe Lys Cys Trp Asn Cys Gly Lys Glu Gly His Ser
          385          390          395          400
Ala Arg Gln Cys Arg Ala Pro Arg Arg Gln Gly Cys Trp Lys Cys Gly
          405          410          415
Lys Pro Gly His Ile Met Thr Asn Cys Pro Asp Arg Gln Ala Gly Phe
          420          425          430
Leu Gly Leu Gly Pro Trp Gly Lys Lys Pro Arg Asn Phe Pro Val Ala
          435          440          445
Gln Val Pro Gln Gly Leu Thr Pro Thr Ala Pro Pro Val Asp Pro Ala
          450          455          460
Val Asp Leu Leu Glu Lys Tyr Met Gln Gln Gly Lys Arg Gln Arg Glu
          465          470          475          480
Gln Arg Glu Arg Pro Tyr Lys Glu Val Thr Glu Asp Leu Leu His Leu
          485          490          495
Glu Gln Gly Glu Thr Pro Tyr Arg Glu Pro Pro Thr Glu Asp Leu Leu
          500          505          510
His Leu Asn Ser Leu Phe Gly Lys Asp Gln
          515          520

```

<210> 217

<211> 860

<212> PRT

<213> Human Immunodeficiency Virus 2

<400> 217

```

Met Glu Pro Gly Arg Asn Gln Leu Phe Val Val Ile Leu Leu Thr Ser
  1          5          10          15
Ala Cys Leu Val Tyr Cys Ser Gln Tyr Val Thr Val Phe Tyr Gly Ile
          20          25          30
Pro Ala Trp Lys Asn Ala Ser Ile Pro Leu Phe Cys Ala Thr Lys Asn
          35          40          45
Arg Asp Thr Trp Gly Thr Ile Gln Cys Leu Pro Asp Asn Asp Asp Tyr
          50          55          60
Gln Glu Ile Ile Leu Asn Val Thr Glu Ala Phe Asp Ala Trp Asn Asn
          65          70          75          80
Thr Val Thr Glu Gln Ala Val Glu Asp Val Trp His Leu Phe Glu Thr
          85          90          95
Ser Ile Lys Pro Cys Val Lys Leu Thr Pro Leu Cys Val Ala Met Asn
          100          105          110
Cys Ser Arg Val Gln Gly Asn Thr Thr Thr Pro Asn Pro Arg Thr Ser
          115          120          125
Ser Ser Thr Thr Ser Arg Pro Pro Thr Ser Ala Ala Ser Ile Ile Asn
          130          135          140
Glu Thr Ser Asn Cys Ile Glu Asn Asn Thr Cys Ala Gly Leu Gly Tyr
          145          150          155          160
Glu Glu Met Met Gln Cys Glu Phe Asn Met Lys Gly Leu Glu Gln Asp
          165          170          175
Lys Lys Arg Arg Tyr Lys Asp Thr Trp Tyr Leu Glu Asp Val Val Cys
          180          185          190
Asp Asn Thr Thr Ala Gly Thr Cys Tyr Met Arg His Cys Asn Thr Ser
          195          200          205
Ile Ile Lys Glu Ser Cys Asp Lys His Tyr Trp Asp Ala Met Arg Phe
          210          215          220

```


Arg Tyr Cys Ala Pro Pro Gly Phe Ala Leu Leu Arg Cys Asn Asp Thr
 225 230 235 240
 Asn Tyr Ser Gly Phe Glu Pro Lys Cys Thr Lys Val Val Ala Ala Ser
 245 250 255
 Cys Thr Arg Met Met Glu Thr Gln Thr Ser Thr Trp Phe Gly Phe Asn
 260 265 270
 Gly Thr Arg Ala Glu Asn Arg Thr Tyr Ile Tyr Trp His Gly Arg Asp
 275 280 285
 Asn Arg Thr Ile Ile Ser Leu Asn Lys Tyr Tyr Asn Leu Thr Met Arg
 290 295 300
 Cys Lys Arg Pro Gly Asn Lys Thr Val Leu Pro Ile Thr Leu Met Ser
 305 310 315 320
 Gly Leu Val Phe His Ser Gln Pro Ile Asn Thr Arg Pro Arg Gln Ala
 325 330 335
 Trp Cys Arg Phe Gly Gly Arg Trp Arg Glu Ala Met Gln Glu Val Lys
 340 345 350
 Gln Thr Leu Val Gln His Pro Arg Tyr Lys Gly Ile Asn Asp Thr Gly
 355 360 365
 Lys Ile Asn Phe Thr Lys Pro Gly Ala Gly Ser Asp Pro Glu Val Ala
 370 375 380
 Phe Met Trp Thr Asn Cys Arg Gly Glu Phe Leu Tyr Cys Asn Met Thr
 385 390 395 400
 Trp Phe Leu Asn Trp Val Glu Asp Lys Asn Gln Thr Arg Arg Asn Tyr
 405 410 415
 Cys His Ile Lys Gln Ile Ile Asn Thr Trp His Lys Val Gly Lys Asn
 420 425 430
 Val Tyr Leu Pro Pro Arg Glu Gly Glu Leu Ala Cys Glu Ser Thr Val
 435 440 445
 Thr Ser Ile Ile Ala Asn Ile Asp Ile Asp Lys Asn Arg Thr His Thr
 450 455 460
 Asn Ile Thr Phe Ser Ala Glu Val Ala Glu Leu Tyr Arg Leu Glu Leu
 465 470 475 480
 Gly Asp Tyr Lys Leu Ile Glu Ile Thr Pro Ile Gly Phe Ala Pro Thr
 485 490 495
 Asp Gln Arg Arg Tyr Ser Ser Thr Pro Val Arg Asn Lys Arg Gly Val
 500 505 510
 Phe Val Leu Gly Phe Leu Gly Phe Leu Ala Thr Ala Gly Ser Ala Met
 515 520 525
 Gly Ala Arg Ser Leu Thr Leu Ser Ala Gln Ser Arg Thr Leu Leu Ala
 530 535 540
 Gly Ile Val Gln Gln Gln Gln Leu Leu Asp Val Val Lys Arg Gln
 545 550 555 560
 Gln Glu Met Leu Arg Leu Thr Val Trp Gly Thr Lys Asn Leu Gln Ala
 565 570 575
 Arg Val Thr Ala Ile Glu Lys Tyr Leu Lys His Gln Ala Gln Leu Asn
 580 585 590
 Ser Trp Gly Cys Ala Phe Arg Gln Val Cys His Thr Thr Val Pro Trp
 595 600 605
 Val Asn Asp Ser Leu Ser Pro Asp Trp Lys Asn Met Thr Trp Gln Glu
 610 615 620
 Trp Glu Lys Gln Val Arg Tyr Leu Glu Ala Asn Ile Ser Gln Ser Leu
 625 630 635 640
 Glu Glu Ala Gln Ile Gln Gln Glu Lys Asn Met Tyr Glu Leu Gln Lys
 645 650 655
 Leu Asn Ser Trp Asp Ile Leu Gly Asn Trp Phe Asp Leu Thr Ser Trp
 660 665 670
 Val Lys Tyr Ile Gln Tyr Gly Val His Ile Val Val Gly Ile Ile Ala
 675 680 685
 Leu Arg Ile Ala Ile Tyr Val Val Gln Leu Leu Ser Arg Phe Arg Lys
 690 695 700
 Gly Tyr Arg Pro Val Phe Ser Ser Pro Pro Gly Tyr Leu Gln Gln Ile

```

705              710              715              720
His Ile His Lys Asp Arg Gly Gln Pro Ala Asn Glu Gly Thr Glu Glu
              725              730              735
Asp Val Gly Gly Asp Ser Gly Tyr Asp Leu Trp Pro Trp Pro Ile Asn
              740              745              750
Tyr Val Gln Phe Leu Ile His Leu Leu Thr Arg Leu Leu Ile Gly Leu
              755              760              765
Tyr Asn Ile Cys Arg Asp Leu Leu Ser Lys Asn Ser Pro Thr Arg Arg
              770              775              780
Leu Ile Ser Gln Ser Leu Thr Ala Ile Arg Asp Trp Leu Arg Leu Lys
785              790              795              800
Ala Ala Gln Leu Gln Tyr Gly Cys Glu Trp Ile Gln Glu Ala Phe Gln
              805              810              815
Ala Phe Ala Arg Thr Thr Arg Glu Thr Leu Ala Gly Ala Trp Gly Trp
              820              825              830
Leu Trp Glu Ala Ala Arg Arg Ile Gly Arg Gly Ile Leu Ala Val Pro
              835              840              845
Arg Arg Ile Arg Gln Gly Ala Glu Leu Ala Leu Leu
              850              855              860

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<210> 218

<211> 25

<212> PRT

<213> Human Immunodeficiency Virus

<400> 218

```

Ser Glu Gly Asp Thr Asp Glu Leu Ala Lys Leu Val Glu Met Gly Asn
  1              5              10              15
Tyr Asp Leu Gly Asp Ala Ser Asp Leu
              20              25

```

<210> 219

<211> 854

<212> PRT

<213> Human Immunodeficiency Virus

<400> 219

```

Met Arg Val Lys Gly Ile Met Arg Asn Cys Gln Gln Trp Trp Ile Trp
  1              5              10              15
Gly Ile Leu Gly Phe Trp Met Leu Leu Ile Cys Asn Gly Glu Gly Asn
              20              25              30
Leu Trp Val Thr Val Tyr Tyr Gly Val Pro Val Trp Lys Glu Ala Lys
              35              40              45
Thr Thr Leu Phe Cys Ala Ser Asp Ala Lys Gly Tyr Glu Arg Glu Val
              50              55              60
His Asn Ile Trp Ala Thr His Ala Cys Val Pro Thr Asp Pro Asn Pro
65              70              75              80
Gln Glu Met Phe Leu His Asn Val Thr Glu Asn Phe Asn Met Trp Lys
              85              90              95
Asn Asp Met Val Asp Gln Met His Glu Asp Ile Ile Ser Leu Trp Asp
              100              105              110
Glu Ser Leu Lys Pro Cys Val Lys Leu Thr Pro Leu Cys Val Thr Leu
              115              120              125
Glu Cys Lys Asn Val Thr Thr Asn Val Thr Ile Asn Asn Ala Thr Ser
              130              135              140
Val Thr Ala Asn Asn Asn Thr Ser Asp Met Lys Asn Cys Ser Phe Asn
145              150              155              160
Ala Thr Thr Glu Val Thr Asp Lys Ile Arg Lys Glu Asn Ala Leu Phe
              165              170              175

```

Tyr Thr Leu Asp Ile Val Pro Leu Asp Glu Asn Gln Asn Asn Ser Asn
 180 185 190
 Tyr Arg Leu Ile Asn Cys Asn Thr Ser Lys Val Thr Gln Ala Cys Pro
 195 200 205
 Lys Val Ser Phe Asp Pro Ile Pro Leu His Tyr Cys Ala Pro Ala Gly
 210 215 220
 Tyr Ala Ile Leu Lys Cys Asn Asn Asn Thr Phe Asn Gly Thr Gly Pro
 225 230 235 240
 Cys Asn Asn Val Ser Thr Ile Gln Cys Thr His Gly Ile Lys Pro Val
 245 250 255
 Val Ser Thr Gln Leu Leu Leu Asn Gly Ser Arg Ala Glu Lys Glu Ile
 260 265 270
 Ile Ile Arg Ser Glu Asn Met Thr Asn Asn Ala Lys Thr Ile Ile Val
 275 280 285
 His Leu Asn Glu Ser Ile Glu Ile Glu Cys Ile Arg Pro Asn Asn Asn
 290 295 300
 Thr Arg Lys Ser Ile Arg Ile Gly Pro Gly Gln Thr Phe Tyr Ala Thr
 305 310 315 320
 Asn Gly Met Ile Gly Asp Ile Arg Gln Ala His Cys Asn Ile Ser Gly
 325 330 335
 Ala Asp Trp Asn Arg Thr Leu Gln Gly Val Gly Arg Lys Leu Ala Gly
 340 345 350
 Tyr Phe Pro Asn Lys Thr Ile Ser Phe Gln Pro Ser Ser Gly Gly Asp
 355 360 365
 Leu Glu Ile Thr Thr His Ser Phe Asn Cys Gly Gly Glu Phe Phe Tyr
 370 375 380
 Cys Asn Thr Ser Ser Leu Phe Asn Asn Thr Tyr Arg Pro Thr Tyr Trp
 385 390 395 400
 Pro Asn Gly Thr Glu Ser Asn Ser Thr Ile Thr Leu Gln Cys Arg Ile
 405 410 415
 Lys Gln Ile Ile Asn Met Trp Gln Lys Val Gly Arg Ala Ile Tyr Ala
 420 425 430
 Pro Pro Ile Ala Gly Lys Ile Thr Cys Lys Ser Asn Ile Thr Gly Leu
 435 440 445
 Leu Leu Val Arg Asp Gly Gly Asn Gly Gly Asn Asn Thr Ala Thr Glu
 450 455 460
 Ile Phe Arg Pro Gly Gly Gly Asn Met Lys Asp Asn Trp Arg Ser Glu
 465 470 475 480
 Leu Tyr Lys Tyr Lys Val Val Glu Ile Lys Pro Leu Gly Ile Ala Pro
 485 490 495
 Thr Gly Ala Lys Arg Arg Val Val Gly Arg Glu Lys Arg Ala Val Gly
 500 505 510
 Ile Gly Ala Val Phe Leu Gly Phe Leu Gly Ala Ala Gly Ser Thr Met
 515 520 525
 Gly Ala Ala Ser Ile Thr Leu Thr Val Gln Ala Arg Gln Leu Leu Ser
 530 535 540
 Gly Ile Val Gln Gln Gln Ser Asn Leu Leu Lys Ala Ile Glu Ala Gln
 545 550 555 560
 His His Leu Leu Gln Leu Thr Val Trp Gly Ile Lys Gln Leu Gln Ala
 565 570 575
 Arg Val Leu Ala Ile Glu Arg Tyr Leu Lys Asp Gln Gln Leu Leu Gly
 580 585 590
 Ile Trp Gly Cys Ser Gly Lys Leu Ile Cys Thr Thr Ala Val Pro Trp
 595 600 605
 Asn Ser Ser Trp Ser Asn Lys Ser Gln Ala Asp Ile Trp Asp Asn Met
 610 615 620
 Thr Trp Met Gln Trp Asp Arg Glu Ile Ser Asn Tyr Thr Asp Thr Ile
 625 630 635 640
 Tyr Arg Leu Leu Glu Val Ser Gln Thr Gln Gln Glu Gln Asn Glu Gln
 645 650 655
 Asp Leu Leu Ala Leu Asn Lys Trp Gln His Leu Trp Asn Trp Phe Asp

Leu Glu Asn Lys Ala Ile His Asp Leu Gly Lys Ala His Gly Ser Leu
 225 230 235 240
 Lys Pro

<210> 221
 <211> 210
 <212> PRT
 <213> Human Immunodeficiency Virus

<220>
 <221> VARIANT
 <222> 31, 97, 140, 141, 144, 178
 <223> Xaa = Any Amino Acid

<400> 221
 Cys Thr Glu Met Glu Lys Glu Gly Lys Ile Ser Lys Ile Gly Pro Glu
 1 5 10 15
 Asn Pro Tyr Asn Thr Pro Val Phe Ala Ile Lys Lys Lys Asp Xaa Thr
 20 25 30
 Lys Trp Arg Lys Leu Val Asp Phe Arg Glu Leu Asn Lys Arg Thr Gln
 35 40 45
 Asp Phe Trp Glu Val Gln Leu Gly Ile Pro His Pro Ala Gly Leu Lys
 50 55 60
 Lys Lys Lys Ser Val Thr Val Leu Asp Val Gly Asp Ala Tyr Phe Ser
 65 70 75 80
 Val Pro Leu Asp Glu Ser Phe Arg Lys Tyr Thr Ala Phe Thr Ile Pro
 85 90 95
 Xaa Thr Asn Asn Glu Thr Pro Gly Ile Arg Tyr Gln Tyr Asn Val Leu
 100 105 110
 Pro Gln Gly Trp Lys Gly Ser Pro Ala Ile Phe Gln Ser Ser Met Thr
 115 120 125
 Lys Ile Leu Glu Pro Phe Arg Ile Lys Asn Pro Xaa Xaa Val Ile Xaa
 130 135 140
 Gln Tyr Met Asp Asp Leu Tyr Val Gly Ser Asp Leu Glu Ile Gly Gln
 145 150 155 160
 His Arg Ala Lys Ile Glu Glu Leu Arg Lys His Leu Leu Ser Trp Gly
 165 170 175
 Phe Xaa Thr Pro Asp Lys Lys His Gln Lys Glu Pro Pro Phe Leu Trp
 180 185 190
 Met Gly Tyr Glu Leu His Pro Asp Lys Trp Thr Val Gln Pro Ile Gln
 195 200 205
 Leu Pro
 210

<210> 222
 <211> 207
 <212> PRT
 <213> Human Immunodeficiency Virus

<400> 222
 Met Gly Gly Lys Trp Ser Lys Ser Ser Leu Val Gly Trp Pro Glu Val
 1 5 10 15
 Arg Asp Arg Ile Arg Arg Thr Asp Pro Ala Ala Glu Gly Val Gly Ala
 20 25 30
 Ala Ser Gln Asp Leu Asp Lys His Gly Ala Leu Thr Asn Ser Asn Thr
 35 40 45
 Ala Ala Thr Asn Lys Asp Cys Ala Trp Leu Glu Ala Gln Glu Glu Glu
 50 55 60

Gly Glu Val Gly Phe Pro Val Arg Pro Gln Val Pro Leu Arg Pro Met
 65 70 75 80
 Thr Tyr Lys Gly Ala Phe Asp Leu Gly Trp Phe Leu Lys Glu Lys Gly
 85 90 95
 Gly Leu Asp Gly Leu Ile Tyr Ser Lys Arg Gln Glu Ile Leu Asp
 100 105 110
 Leu Trp Val Tyr His Thr Gln Gly Tyr Phe Pro Asp Trp Gln Asn Tyr
 115 120 125
 Thr Pro Gly Pro Gly Val Arg Tyr Pro Leu Thr Phe Gly Trp Cys Tyr
 130 135 140
 Lys Leu Val Pro Val Asp Pro Lys Glu Val Glu Glu Ala Thr Glu Gly
 145 150 155 160
 Glu Asn Asn Cys Leu His Pro Ile Cys Gln His Gly Met Glu Asp
 165 170 175
 Glu Asp Arg Glu Val Leu Arg Trp Lys Phe Asp Ser Glu Leu Ala Arg
 180 185 190
 Arg His Ile Ala Arg Glu Arg His Pro Glu Phe Tyr Lys Asp Cys
 195 200 205

<210> 223

<211> 397

<212> PRT

<213> Plasmodium falciparum

<400> 223

Met Met Arg Lys Leu Ala Ile Leu Ser Val Ser Ser Phe Leu Phe Val
 1 5 10 15
 Glu Ala Leu Phe Gln Glu Tyr Gln Cys Tyr Gly Ser Ser Ser Asn Thr
 20 25 30
 Arg Val Leu Asn Glu Leu Asn Tyr Asp Asn Ala Gly Thr Asn Leu Tyr
 35 40 45
 Asn Glu Leu Glu Met Asn Tyr Tyr Gly Lys Gln Glu Asn Trp Tyr Ser
 50 55 60
 Leu Lys Lys Asn Ser Arg Ser Leu Gly Glu Asn Asp Asp Gly Asn Asn
 65 70 75 80
 Glu Asp Asn Glu Lys Leu Arg Lys Pro Lys His Lys Lys Leu Lys Gln
 85 90 95
 Pro Ala Asp Gly Asn Pro Asp Pro Asn Ala Asn Pro Asn Val Asp Pro
 100 105 110
 Asn Ala Asn Pro Asn Val Asp Pro Asn Ala Asn Pro Asn Val Asp Pro
 115 120 125
 Asn Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro
 130 135 140
 Asn Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro
 145 150 155 160
 Asn Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro
 165 170 175
 Asn Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro
 180 185 190
 Asn Ala Asn Pro Asn Val Asp Pro Asn Ala Asn Pro Asn Ala Asn Pro
 195 200 205
 Asn Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro
 210 215 220
 Asn Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro
 225 230 235 240
 Asn Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro
 245 250 255
 Asn Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro
 260 265 270
 Asn Lys Asn Asn Gln Gly Asn Gly Gln Gly His Asn Met Pro Asn Asp

```

      275      280      285
Pro Asn Arg Asn Val Asp Glu Asn Ala Asn Ala Asn Ser Ala Val Lys
  290      295      300
Asn Asn Asn Asn Glu Glu Pro Ser Asp Lys His Ile Lys Glu Tyr Leu
305      310      315      320
Asn Lys Ile Gln Asn Ser Leu Ser Thr Glu Trp Ser Pro Cys Ser Val
      325      330      335
Thr Cys Gly Asn Gly Ile Gln Val Arg Ile Lys Pro Gly Ser Ala Asn
      340      345      350
Lys Pro Lys Asp Glu Leu Asp Tyr Ala Asn Asp Ile Glu Lys Lys Ile
      355      360      365
Cys Lys Met Glu Lys Cys Ser Ser Val Phe Asn Val Val Asn Ser Ser
      370      375      380
Ile Gly Leu Ile Met Val Leu Ser Phe Leu Phe Leu Asn
385      390      395

```

<210> 224
 <211> 69
 <212> PRT
 <213> Plasmodium falciparum

```

<400> 224
Thr Glu Trp Ser Pro Cys Ser Val Thr Cys Gly Asn Gly Ile Gln Val
  1      5      10      15
Arg Ile Lys Pro Gly Ser Ala Asn Lys Pro Lys Asp Glu Leu Asp Tyr
      20      25      30
Glu Asn Asp Ile Glu Lys Lys Ile Cys Lys Met Glu Lys Cys Ser Ser
      35      40      45
Val Phe Asn Val Val Asn Ser Ser Ile Gly Leu Ile Met Val Leu Ser
      50      55      60
Phe Leu Phe Leu Asn
65

```

<210> 225
 <211> 137
 <212> PRT
 <213> Salmonella enterica

```

<400> 225
Met Tyr Met Ser Lys Tyr Val Pro Val Tyr Thr Leu Leu Ile Leu Ile
  1      5      10      15
Tyr Ser Phe Asn Ala Ser Ala Glu Trp Thr Gly Asp Asn Thr Asn Ala
      20      25      30
Tyr Tyr Ser Asp Glu Val Ile Ser Glu Leu His Val Gly Gln Ile Asp
      35      40      45
Thr Ser Pro Tyr Phe Cys Ile Lys Thr Val Lys Ala Asn Gly Ser Gly
      50      55      60
Thr Pro Val Val Ala Cys Ala Val Ser Lys Gln Ser Ile Trp Ala Pro
65      70      75      80
Ser Phe Lys Glu Leu Leu Asp Gln Ala Arg Tyr Phe Tyr Ser Thr Gly
      85      90      95
Gln Ser Val Arg Ile His Val Gln Lys Asn Ile Trp Thr Tyr Pro Leu
      100      105      110
Phe Val Asn Thr Phe Ser Ala Asn Ala Leu Val Gly Leu Ser Ser Cys
      115      120      125
Ser Ala Thr Gln Cys Phe Gly Pro Lys
      130      135

```

<210> 226
 <211> 233
 <212> PRT
 <213> *Staphylococcus aureus*

<400> 226
 Ser Glu Lys Ser Glu Glu Ile Asn Glu Lys Asp Leu Arg Lys Lys Ser
 1 5 10 15
 Glu Leu Gln Gly Thr Ala Leu Gly Asn Leu Lys Gln Ile Tyr Tyr Tyr
 20 25 30
 Asn Glu Lys Ala Lys Thr Glu Asn Lys Glu Ser His Asp Gln Phe Leu
 35 40 45
 Gln His Thr Ile Leu Phe Lys Gly Phe Phe Thr Asp His Ser Trp Tyr
 50 55 60
 Asn Asp Leu Leu Val Asp Phe Asp Ser Lys Asp Ile Val Asp Lys Tyr
 65 70 75 80
 Lys Gly Lys Lys Val Asp Leu Tyr Gly Ala Tyr Tyr Gly Tyr Gln Cys
 85 90 95
 Ala Gly Gly Thr Pro Asn Lys Thr Ala Cys Met Tyr Gly Gly Val Thr
 100 105 110
 Leu His Asp Asn Asn Arg Leu Thr Glu Glu Lys Lys Val Pro Ile Asn
 115 120 125
 Leu Trp Leu Asp Gly Lys Gln Asn Thr Val Pro Leu Glu Thr Val Lys
 130 135 140
 Thr Asn Lys Lys Asn Val Thr Val Gln Glu Leu Asp Leu Gln Ala Arg
 145 150 155 160
 Arg Tyr Leu Gln Glu Lys Tyr Asn Leu Tyr Asn Ser Asp Val Phe Asp
 165 170 175
 Gly Lys Val Gln Arg Gly Leu Ile Val Phe His Thr Ser Thr Glu Pro
 180 185 190
 Ser Val Asn Tyr Asp Leu Phe Gly Ala Gln Gly Gln Tyr Ser Asn Thr
 195 200 205
 Leu Leu Arg Ile Tyr Arg Asp Asn Lys Ser Ile Asn Ser Glu Asn Met
 210 215 220
 His Ile Asp Ile Tyr Leu Tyr Thr Ser
 225 230

<210> 227
 <211> 68
 <212> PRT
 <213> *Escherichia coli*

<400> 227
 Ala Trp Arg Glu Glu Pro Trp Ile His His Ala Pro Gln Gly Cys Gly
 1 5 10 15
 Asp Ser Ser Arg Thr Ile Thr Gly Asp Thr Cys Asn Glu Glu Thr Gln
 20 25 30
 Asn Leu Ser Thr Ile Tyr Leu Arg Lys Tyr Gln Ser Lys Val Lys Arg
 35 40 45
 Gln Ile Phe Ser Asp Tyr Gln Ser Glu Val Asp Ile Tyr Asn Arg Ile
 50 55 60
 Arg Asn Glu Leu
 65

<210> 228
 <211> 396
 <212> PRT
 <213> *Clostridium difficile*

<400> 228

```

Asn Glu Tyr Tyr Pro Glu Ile Ile Val Leu Asn Pro Asn Thr Phe His
 1          5          10          15
Lys Lys Val Asn Ile Asn Leu Asp Ser Ser Ser Phe Glu Tyr Lys Trp
          20          25          30
Ser Thr Glu Gly Ser Asp Phe Ile Leu Val Arg Tyr Leu Glu Glu Ser
          35          40          45
Asn Lys Lys Ile Leu Gln Lys Ile Arg Ile Lys Gly Ile Leu Ser Asn
          50          55          60
Thr Lys Ser Phe Asn Lys Met Ser Ile Asp Phe Lys Asp Ile Lys Lys
65          70          75          80
Leu Ser Leu Gly Tyr Ile Met Ser Asn Phe Lys Ser Phe Asn Ser Glu
          85          90          95
Asn Glu Leu Asp Arg Asp His Leu Gly Phe Lys Ile Ile Asp Asn Lys
          100          105          110
Thr Tyr Tyr Tyr Asp Glu Ala Ser Lys Leu Val Lys Gly Leu Ile Asn
          115          120          125
Ile Asn Asn Ser Leu Phe Tyr Phe Asp Pro Ile Glu Ser Asn Leu Val
          130          135          140
Thr Gly Trp Gln Thr Ile Asn Gly Lys Lys Tyr Tyr Phe Asp Ile Asn
145          150          155          160
Thr Gly Ala Ala Ser Thr Ser Tyr Lys Ile Ile Asn Gly Lys His Phe
          165          170          175
Tyr Phe Asn Asn Asn Gly Val Met Gln Leu Gly Val Phe Lys Gly Pro
          180          185          190
Asp Gly Phe Glu Tyr Phe Ala Pro Ala Asn Thr Gln Asn Asn Asn Ile
          195          200          205
Glu Gly Gln Ala Ile Val Tyr Gln Ser Lys Phe Leu Thr Leu Asn Gly
          210          215          220
Lys Lys Tyr Tyr Phe Asp Asn Asp Ser Lys Ala Val Thr Gly Trp Gln
225          230          235          240
Thr Ile Asp Gly Lys Lys Tyr Tyr Phe Asn Leu Asn Thr Ala Glu Ala
          245          250          255
Ala Thr Gly Trp Gln Thr Ile Asp Gly Lys Lys Tyr Tyr Phe Asn Thr
          260          265          270
Asn Thr Ser Ile Ala Ser Thr Gly Tyr Thr Ile Ile Asn Gly Lys His
          275          280          285
Phe Tyr Phe Asn Thr Asp Gly Ile Met Gln Ile Gly Val Phe Lys Gly
          290          295          300
Pro Asn Gly Phe Glu Tyr Phe Ala Pro Ala Asn Thr Asp Ala Asn Asn
305          310          315          320
Ile Glu Gly Gln Ala Ile Arg Tyr Gln Asn Arg Phe Leu Tyr Leu His
          325          330          335
Asp Asn Ile Tyr Tyr Phe Gly Asn Asn Ser Lys Ala Val Thr Gly Trp
          340          345          350
Gln Thr Ile Asn Gly Asn Val Tyr Tyr Phe Met Pro Asp Thr Ala Met
          355          360          365
Ala Ala Ala Gly Gly Leu Phe Glu Ile Asp Gly Val Ile Tyr Phe Phe
          370          375          380
Gly Val Asp Gly Val Lys Ala Pro Gly Ile Tyr Gly
385          390          395

```

<210> 229

<211> 386

<212> PRT

<213> *Bacillus cereus*

<400> 229

```

Met Lys Lys Thr Leu Ile Thr Gly Leu Leu Val Thr Ala Val Ser Thr
 1          5          10          15

```

Ser Arg Phe Ile Pro Val Ser Ala Tyr Ala Lys Glu Gly Gln Thr Glu
 20 25 30
 Val Lys Thr Val Tyr Ala Gln Asn Val Ile Ala Pro Asn Thr Leu Ser
 35 40 45
 Asn Ser Ile Arg Met Leu Gly Ser Gln Ser Pro Leu Ile Gln Ala Tyr
 50 55 60
 Gly Leu Ile Ile Leu Gln Gln Pro Asp Ile Lys Val Asn Ala Met Ser
 65 70 75 80
 Ser Leu Thr Asn His Gln Lys Phe Ala Lys Ala Asn Val Arg Glu Trp
 85 90 95
 Ile Asp Glu Tyr Asn Pro Lys Leu Ile Asp Leu Asn Gln Glu Met Met
 100 105 110
 Arg Tyr Ser Thr Arg Phe Asn Ser Tyr Tyr Ser Lys Leu Tyr Glu Leu
 115 120 125
 Ala Gly Asn Val Asn Glu Asp Gln Gln Ala Lys Ala Asp Phe Met Ser
 130 135 140
 Ala Tyr Gly Lys Leu Gln Leu Gln Val Gln Ser Ile Gln Glu Ser Met
 145 150 155 160
 Glu Gln Asp Leu Leu Glu Leu Asn Arg Phe Lys Thr Val Leu Asp Lys
 165 170 175
 Asp Ser Asn Asn Leu Ser Ile Lys Ala Asp Glu Ala Ile Lys Thr Leu
 180 185 190
 Gln Gly Ser Ser Gly Asp Ile Val Lys Leu Arg Glu Asp Ile Lys Arg
 195 200 205
 Ile Gln Gly Glu Ile Gln Ala Glu Leu Thr Thr Ile Leu Asn Arg Pro
 210 215 220
 Gln Glu Ile Ile Lys Gly Ser Ile Asn Ile Gly Lys Gln Val Phe Thr
 225 230 235 240
 Ile Thr Asn Gln Thr Ala Gln Thr Lys Thr Ile Asp Phe Val Ser Ile
 245 250 255
 Gly Thr Leu Ser Asn Glu Ile Val Asn Ala Ala Asp Ser Gln Thr Arg
 260 265 270
 Glu Ala Ala Leu Arg Ile Gln Gln Lys Gln Lys Glu Leu Leu Pro Leu
 275 280 285
 Ile Gln Lys Leu Ser Gln Thr Glu Ala Glu Ala Thr Gln Ile Thr Phe
 290 295 300
 Val Glu Asp Gln Val Asn Ser Phe Thr Glu Leu Ile Asp Arg Gln Ile
 305 310 315 320
 Thr Thr Leu Glu Thr Leu Leu Thr Asp Trp Lys Val Leu Asn Asn Asn
 325 330 335
 Met Ile Gln Ile Gln Lys Asn Val Glu Glu Gly Thr Tyr Thr Asp Ser
 340 345 350
 Ser Leu Leu Gln Lys His Phe Asn Gln Ile Lys Lys Val Ser Asp Glu
 355 360 365
 Met Asn Lys Gln Thr Asn Gln Phe Glu Asp Tyr Val Thr Asn Val Glu
 370 375 380
 Val His
 385

<210> 230

<211> 227

<212> PRT

<213> Bordetella pertussis

<400> 230

Met Leu Ile Asn Asn Lys Lys Leu Leu His His Ile Leu Pro Ile Leu
 1 5 10 15
 Val Leu Ala Leu Leu Gly Met Arg Thr Ala Gln Ala Val Ala Pro Gly
 20 25 30
 Ile Val Ile Pro Pro Lys Ala Leu Phe Thr Gln Gln Gly Gly Ala Tyr

```

      35              40              45
Gly Arg Cys Pro Asn Gly Thr Arg Ala Leu Thr Val Ala Glu Leu Arg
  50              55              60
Gly Asn Ala Glu Leu Gln Thr Tyr Leu Arg Gln Ile Thr Pro Gly Trp
  65              70              75              80
Ser Ile Tyr Gly Leu Tyr Asp Gly Thr Tyr Leu Gly Gln Ala Tyr Gly
      85              90              95
Gly Ile Ile Lys Asp Ala Pro Pro Gly Ala Gly Phe Ile Tyr Arg Glu
      100              105              110
Thr Phe Cys Ile Thr Thr Ile Tyr Lys Thr Gly Gln Pro Ala Ala Asp
      115              120              125
His Tyr Tyr Ser Lys Val Thr Ala Thr Arg Leu Leu Ala Ser Thr Asn
      130              135              140
Ser Arg Leu Cys Ala Val Phe Val Arg Asp Gly Gln Ser Val Ile Gly
      145              150              155              160
Ala Cys Ala Ser Pro Tyr Glu Gly Arg Tyr Arg Asp Met Tyr Asp Ala
      165              170              175
Leu Arg Arg Leu Leu Tyr Met Ile Tyr Met Ser Gly Leu Ala Val Arg
      180              185              190
Val His Val Ser Lys Glu Glu Gln Tyr Tyr Asp Tyr Glu Asp Ala Thr
      195              200              205
Phe Gln Thr Tyr Ala Leu Thr Gly Ile Ser Leu Cys Asn Pro Ala Ala
      210              215              220
Ser Ile Cys
      225

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<210> 231
 <211> 76
 <212> PRT
 <213> SARS coronavirus

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<400> 231
Met Tyr Ser Phe Val Ser Glu Glu Thr Gly Thr Leu Ile Val Asn Ser
  1              5              10              15
Val Leu Leu Phe Leu Ala Phe Val Val Phe Leu Leu Val Thr Leu Ala
      20              25              30
Ile Leu Thr Ala Leu Arg Leu Cys Ala Tyr Cys Cys Asn Ile Val Asn
      35              40              45
Val Ser Leu Val Lys Pro Thr Val Tyr Val Tyr Ser Arg Val Lys Asn
      50              55              60
Leu Asn Ser Ser Glu Gly Val Pro Asp Leu Leu Val
      65              70              75

```

<210> 232
 <211> 125
 <212> PRT
 <213> Homo sapiens

```

<400> 232
Gln Ile Lys Leu Met Leu Glu Asn Arg Ala Met Val Arg Arg Lys Gly
  1              5              10              15
Phe Gly Ile Leu Ile Gly Val Tyr Gly Ser Ser Val Ile Tyr Met Val
      20              25              30
Gln Leu Pro Ile Phe Gly Val Ile Asp Thr Pro Cys Trp Ile Ile Lys
      35              40              45
Ala Ala Pro Ser Cys Ser Glu Lys Asp Gly Asn Tyr Ala Cys Leu Leu
      50              55              60
Arg Glu Asp Gln Gly Trp Tyr Cys Lys Asn Ala Gly Ser Thr Val Tyr

```

65					70					75				80
Tyr	Pro	Asn	Glu	Lys	Asp	Cys	Glu	Thr	Arg	Gly	Asp	His	Val	Phe
				85					90					95
Asp	Thr	Ala	Ala	Gly	Ile	Asn	Val	Ala	Glu	Gln	Ser	Arg	Glu	Cys
			100					105					110	Asn
Ile	Asn	Ile	Ser	Thr	Thr	Asn	Tyr	Pro	Cys	Lys	Val	Ser		
		115					120					125		

<210> 233
 <211> 221
 <212> PRT
 <213> SARS coronavirus

<400> 233

Met	Ala	Asp	Asn	Gly	Thr	Ile	Thr	Val	Glu	Glu	Leu	Lys	Gln	Leu	Leu
1				5					10					15	
Glu	Gln	Trp	Asn	Leu	Val	Ile	Gly	Phe	Leu	Phe	Leu	Ala	Trp	Ile	Met
			20				25						30		
Leu	Leu	Gln	Phe	Ala	Tyr	Ser	Asn	Arg	Asn	Arg	Phe	Leu	Tyr	Ile	Ile
		35					40					45			
Lys	Leu	Val	Phe	Leu	Trp	Leu	Leu	Trp	Pro	Val	Thr	Leu	Ala	Cys	Phe
	50					55					60				
Val	Leu	Ala	Ala	Val	Tyr	Arg	Ile	Asn	Trp	Val	Thr	Gly	Gly	Ile	Ala
65				70						75				80	
Ile	Ala	Met	Ala	Cys	Ile	Val	Gly	Leu	Met	Trp	Leu	Ser	Tyr	Phe	Val
			85						90					95	
Ala	Ser	Phe	Arg	Leu	Phe	Ala	Arg	Thr	Arg	Ser	Met	Trp	Ser	Phe	Asn
			100					105					110		
Pro	Glu	Thr	Asn	Ile	Leu	Leu	Asn	Val	Pro	Leu	Arg	Gly	Thr	Ile	Val
		115					120					125			
Thr	Arg	Pro	Leu	Met	Glu	Ser	Glu	Leu	Val	Ile	Gly	Ala	Val	Ile	Ile
	130					135					140				
Arg	Gly	His	Leu	Arg	Met	Ala	Gly	His	Ser	Leu	Gly	Arg	Cys	Asp	Ile
145					150					155				160	
Lys	Asp	Leu	Pro	Lys	Glu	Ile	Thr	Val	Ala	Thr	Ser	Arg	Thr	Leu	Ser
				165					170					175	
Tyr	Tyr	Lys	Leu	Gly	Ala	Ser	Gln	Arg	Val	Gly	Thr	Asp	Ser	Gly	Phe
		180						185				190			
Ala	Ala	Tyr	Asn	Arg	Tyr	Arg	Ile	Gly	Asn	Tyr	Lys	Leu	Asn	Thr	Asp
		195					200					205			
His	Ala	Gly	Ser	Asn	Asp	Asn	Ile	Ala	Leu	Leu	Val	Gln			
	210					215					220				

<210> 234
 <211> 422
 <212> PRT
 <213> SARS coronavirus

<400> 234

Met	Ser	Asp	Asn	Gly	Pro	Gln	Ser	Asn	Gln	Arg	Ser	Ala	Pro	Arg	Ile
1				5					10					15	
Thr	Phe	Gly	Gly	Pro	Thr	Asp	Ser	Thr	Asp	Asn	Asn	Gln	Asn	Gly	Gly
		20						25					30		
Arg	Asn	Gly	Ala	Arg	Pro	Lys	Gln	Arg	Arg	Pro	Gln	Gly	Leu	Pro	Asn
		35				40						45			
Asn	Thr	Ala	Ser	Trp	Phe	Thr	Ala	Leu	Thr	Gln	His	Gly	Lys	Glu	Glu
	50					55					60				
Leu	Arg	Phe	Pro	Arg	Gly	Gln	Gly	Val	Pro	Ile	Asn	Thr	Asn	Ser	Gly
65					70					75					80

Pro Asp Asp Gln Ile Gly Tyr Tyr Arg Arg Ala Thr Arg Arg Val Arg
 85 90 95
 Gly Gly Asp Gly Lys Met Lys Glu Leu Ser Pro Arg Trp Tyr Phe Tyr
 100 105 110
 Tyr Leu Gly Thr Gly Pro Glu Ala Ser Leu Pro Tyr Gly Ala Asn Lys
 115 120 125

 Glu Gly Ile Val Trp Val Ala Thr Glu Gly Ala Leu Asn Thr Pro Lys
 130 135 140
 Asp His Ile Gly Thr Arg Asn Pro Asn Asn Asn Ala Ala Thr Val Leu
 145 150 155 160
 Gln Leu Pro Gln Gly Thr Thr Leu Pro Lys Gly Phe Tyr Ala Glu Gly
 165 170 175
 Ser Arg Gly Gly Ser Gln Ala Ser Ser Arg Ser Ser Ser Arg Ser Arg
 180 185 190
 Gly Asn Ser Arg Asn Ser Thr Pro Gly Ser Ser Arg Gly Asn Ser Pro
 195 200 205
 Ala Arg Met Ala Ser Gly Gly Gly Glu Thr Ala Leu Ala Leu Leu Leu
 210 215 220
 Leu Asp Arg Leu Asn Gln Leu Glu Ser Lys Val Ser Gly Lys Gly Gln
 225 230 235 240
 Gln Gln Gln Gly Gln Thr Val Thr Lys Lys Ser Ala Ala Glu Ala Ser
 245 250 255
 Lys Lys Pro Arg Gln Lys Arg Thr Ala Thr Lys Gln Tyr Asn Val Thr
 260 265 270
 Gln Ala Phe Gly Arg Arg Gly Pro Glu Gln Thr Gln Gly Asn Phe Gly
 275 280 285
 Asp Gln Asp Leu Ile Arg Gln Gly Thr Asp Tyr Lys His Trp Pro Gln
 290 295 300
 Ile Ala Gln Phe Ala Pro Ser Ala Ser Ala Phe Phe Gly Met Ser Arg
 305 310 315 320
 Ile Gly Met Glu Val Thr Pro Ser Gly Thr Trp Leu Thr Tyr His Gly
 325 330 335
 Ala Ile Lys Leu Asp Asp Lys Asp Pro Gln Phe Lys Asp Asn Val Ile
 340 345 350
 Leu Leu Asn Lys His Ile Asp Ala Tyr Lys Thr Phe Pro Pro Thr Glu
 355 360 365
 Pro Lys Lys Asp Lys Lys Lys Lys Thr Asp Glu Ala Gln Pro Leu Pro
 370 375 380
 Gln Arg Gln Lys Lys Gln Pro Thr Val Thr Leu Leu Pro Ala Ala Asp
 385 390 395 400
 Met Asp Asp Phe Ser Arg Gln Leu Gln Asn Ser Met Ser Gly Ala Ser
 405 410 415
 Ala Asp Ser Thr Gln Ala
 420

<210> 235

<211> 1255

<212> PRT

<213> Human Immunodeficiency Virus

<400> 235

Met Phe Ile Phe Leu Leu Phe Leu Thr Leu Thr Ser Gly Ser Asp Leu
 1 5 10 15
 Asp Arg Cys Thr Thr Phe Asp Asp Val Gln Ala Pro Asn Tyr Thr Gln
 20 25 30
 His Thr Ser Ser Met Arg Gly Val Tyr Tyr Pro Asp Glu Ile Phe Arg
 35 40 45
 Ser Asp Thr Leu Tyr Leu Thr Gln Asp Leu Phe Leu Pro Phe Tyr Ser
 50 55 60

Asn	Val	Thr	Gly	Phe	His	Thr	Ile	Asn	His	Thr	Phe	Gly	Asn	Pro	Val	65	70	75	80
Ile	Pro	Phe	Lys	Asp	Gly	Ile	Tyr	Phe	Ala	Ala	Thr	Glu	Lys	Ser	Asn				
				85					90					95					
Val	Val	Arg	Gly	Trp	Val	Phe	Gly	Ser	Thr	Met	Asn	Asn	Lys	Ser	Gln				
			100					105					110						
Ser	Val	Ile	Ile	Ile	Asn	Asn	Ser	Thr	Asn	Val	Val	Ile	Arg	Ala	Cys				
			115				120					125							
Asn	Phe	Glu	Leu	Cys	Asp	Asn	Pro	Phe	Phe	Ala	Val	Ser	Lys	Pro	Met				
			130			135					140								
Gly	Thr	Gln	Thr	His	Thr	Met	Ile	Phe	Asp	Asn	Ala	Phe	Asn	Cys	Thr				
145					150					155					160				
Phe	Glu	Tyr	Ile	Ser	Asp	Ala	Phe	Ser	Leu	Asp	Val	Ser	Glu	Lys	Ser				
				165					170					175					
Gly	Asn	Phe	Lys	His	Leu	Arg	Glu	Phe	Val	Phe	Lys	Asn	Lys	Asp	Gly				
			180					185					190						
Phe	Leu	Tyr	Val	Tyr	Lys	Gly	Tyr	Gln	Pro	Ile	Asp	Val	Val	Arg	Asp				
			195				200					205							
Leu	Pro	Ser	Gly	Phe	Asn	Thr	Leu	Lys	Pro	Ile	Phe	Lys	Leu	Pro	Leu				
			210			215						220							
Gly	Ile	Asn	Ile	Thr	Asn	Phe	Arg	Ala	Ile	Leu	Thr	Ala	Phe	Ser	Pro				
225					230					235					240				
Ala	Gln	Asp	Ile	Trp	Gly	Thr	Ser	Ala	Ala	Ala	Tyr	Phe	Val	Gly	Tyr				
				245					250					255					
Leu	Lys	Pro	Thr	Thr	Phe	Met	Leu	Lys	Tyr	Asp	Glu	Asn	Gly	Thr	Ile				
			260					265					270						
Thr	Asp	Ala	Val	Asp	Cys	Ser	Gln	Asn	Pro	Leu	Ala	Glu	Leu	Lys	Cys				
			275				280					285							
Ser	Val	Lys	Ser	Phe	Glu	Ile	Asp	Lys	Gly	Ile	Tyr	Gln	Thr	Ser	Asn				
			290			295					300								
Phe	Arg	Val	Val	Pro	Ser	Gly	Asp	Val	Val	Arg	Phe	Pro	Asn	Ile	Thr				
305					310					315					320				
Asn	Leu	Cys	Pro	Phe	Gly	Glu	Val	Phe	Asn	Ala	Thr	Lys	Phe	Pro	Ser				
				325					330					335					
Val	Tyr	Ala	Trp	Glu	Arg	Lys	Lys	Ile	Ser	Asn	Cys	Val	Ala	Asp	Tyr				
			340					345					350						
Ser	Val	Leu	Tyr	Asn	Ser	Thr	Phe	Phe	Ser	Thr	Phe	Lys	Cys	Tyr	Gly				
			355				360					365							
Val	Ser	Ala	Thr	Lys	Leu	Asn	Asp	Leu	Cys	Phe	Ser	Asn	Val	Tyr	Ala				
			370			375					380								
Asp	Ser	Phe	Val	Val	Lys	Gly	Asp	Asp	Val	Arg	Gln	Ile	Ala	Pro	Gly				
385					390					395				400					
Gln	Thr	Gly	Val	Ile	Ala	Asp	Tyr	Asn	Tyr	Lys	Leu	Pro	Asp	Asp	Phe				
				405					410					415					
Met	Gly	Cys	Val	Leu	Ala	Trp	Asn	Thr	Arg	Asn	Ile	Asp	Ala	Thr	Ser				
			420					425					430						
Thr	Gly	Asn	Tyr	Asn	Tyr	Lys	Tyr	Arg	Tyr	Leu	Arg	His	Gly	Lys	Leu				
			435				440					445							
Arg	Pro	Phe	Glu	Arg	Asp	Ile	Ser	Asn	Val	Pro	Phe	Ser	Pro	Asp	Gly				
			450			455					460								
Lys	Pro	Cys	Thr	Pro	Pro	Ala	Leu	Asn	Cys	Tyr	Trp	Pro	Leu	Asn	Asp				
465					470					475				480					
Tyr	Gly	Phe	Tyr	Thr	Thr	Thr	Gly	Ile	Gly	Tyr	Gln	Pro	Tyr	Arg	Val				
				485					490					495					
Val	Val	Leu	Ser	Phe	Glu	Leu	Leu	Asn	Ala	Pro	Ala	Thr	Val	Cys	Gly				
			500					505					510						
Pro	Lys	Leu	Ser	Thr	Asp	Leu	Ile	Lys	Asn	Gln	Cys	Val	Asn	Phe	Asn				
			515				520					525							
Phe	Asn	Gly	Leu	Thr	Gly	Thr	Gly	Val	Leu	Thr	Pro	Ser	Ser	Lys	Arg				
			530			535					540								
Phe	Gln	Pro	Phe	Gln	Gln	Phe	Gly	Arg	Asp	Val	Ser	Asp	Phe	Thr	Asp				

Gly	Val	Val	Phe	Leu	His	Val	Thr	Tyr	Val	Pro	Ser	Gln	Glu	Arg	Asn			
								1045							1050			1055
Phe	Thr	Thr	Ala	Pro	Ala	Ile	Cys	His	Glu	Gly	Lys	Ala	Tyr	Phe	Pro			
								1060							1065			1070
Arg	Glu	Gly	Val	Phe	Val	Phe	Asn	Gly	Thr	Ser	Trp	Phe	Ile	Thr	Gln			
								1075							1080			1085
Arg	Asn	Phe	Phe	Ser	Pro	Gln	Ile	Ile	Thr	Thr	Asp	Asn	Thr	Phe	Val			
								1090							1095			1100
Ser	Gly	Asn	Cys	Asp	Val	Val	Ile	Gly	Ile	Ile	Asn	Asn	Thr	Val	Tyr			
								1105							1110			1115
Asp	Pro	Leu	Gln	Pro	Glu	Leu	Asp	Ser	Phe	Lys	Glu	Glu	Leu	Asp	Lys			
								1125							1130			1135
Tyr	Phe	Lys	Asn	His	Thr	Ser	Pro	Asp	Val	Asp	Phe	Gly	Asp	Ile	Ser			
								1140							1145			1150
Gly	Ile	Asn	Ala	Ser	Val	Val	Asn	Ile	Gln	Lys	Glu	Ile	Asp	Arg	Leu			
								1155							1160			1165
Asn	Glu	Val	Ala	Lys	Asn	Leu	Asn	Glu	Ser	Leu	Ile	Asp	Leu	Gln	Glu			
								1170							1175			1180
Leu	Gly	Lys	Tyr	Glu	Gln	Tyr	Ile	Lys	Trp	Pro	Trp	Tyr	Val	Trp	Leu			
								1185							1190			1195
Gly	Phe	Ile	Ala	Gly	Leu	Ile	Ala	Ile	Val	Met	Val	Thr	Ile	Leu	Leu			
								1205							1210			1215
Cys	Cys	Met	Thr	Ser	Cys	Cys	Ser	Cys	Leu	Lys	Gly	Ala	Cys	Ser	Cys			
								1220							1225			1230
Gly	Ser	Cys	Cys	Lys	Phe	Asp	Glu	Asp	Asp	Ser	Glu	Pro	Val	Leu	Lys			
								1235							1240			1245
Gly	Val	Lys	Leu	His	Tyr	Thr												
								1250							1255			

```
<210> 236
<211> 28
<212> PRT
<213> Human Immunodeficiency Virus
```

```

<400> 236
Asx Thr Thr Met Phe Phe Arg Met Pro Gln Asp Leu Asn Thr Met Leu
 1          5          10          15
Asn Thr Val Gly His Gln Ala Ala Met Gln Met
 20          25

```

```
<210> 237
<211> 20
<212> PRT
<213> Human Immunodeficiency Virus
```

```
<400> 237
Pro Gln Asp Leu Asn Thr Met Leu Asn Thr Val Gly Gly His Gln Ala
 1              5              10              15
Ala Met Gln Met
          20
```

```
<210> 238
<211> 20
<212> PRT
<213> Human Immunodeficiency Virus
```

<400> 238
Gly Pro Ile Ala Pro Gly Gln Met Arg Glu Pro Arg Gly Ser Asp Ile

69/91

1	5	10	15
Ala Gly Thr Thr			
20			

<210> 239
<211> 20
<212> PRT
<213> Human Immunodeficiency Virus

<400> 239			
Gly Pro Ile	Ala Pro Gly Gln Met Arg	Glu Pro Arg Gly Ser	Asp Ile
1	5	10	15
Ala Gly Thr Thr			
20			

<210> 240
<211> 20
<212> PRT
<213> Human Immunodeficiency Virus

<400> 240			
Lys Gly Cys Trp	Lys Cys Gly Lys Glu	Gly His Gln Met Lys	Asp Cys
1	5	10	15
Thr Glu Arg Gln			
20			

<210> 241
<211> 20
<212> PRT
<213> Human Immunodeficiency Virus

<400> 241			
Lys Gly Cys Trp	Lys Cys Gly Lys Glu	Gly His Gln Met Lys	Asp Cys
1	5	10	15
Thr Glu Arg Gln			
20			

<210> 242
<211> 20
<212> PRT
<213> Human Immunodeficiency Virus

<400> 242			
His Gln Met Lys	Asp Cys Thr Glu Arg	Gln Ala Asn Phe Leu	Gly Lys
1	5	10	15
Ile Trp Pro Ser			
20			

<210> 243
<211> 20
<212> PRT
<213> Human Immunodeficiency Virus

<400> 243			
His Gln Met Lys	Asp Cys Thr Glu Arg	Gln Ala Asn Phe Leu	Gly Lys
1	5	10	15

Ile Trp Pro Ser
20

<210> 244
<211> 20
<212> PRT
<213> Human Immunodeficiency Virus

<400> 244
His Gln Met Lys Asp Cys Thr Glu Arg Gln Ala Asn Phe Leu Gly Lys
1 5 10 15
Ile Trp Pro Ser
20

<210> 245
<211> 20
<212> PRT
<213> Human Immunodeficiency Virus

<400> 245
Ala Thr Leu Glu Glu Met Met Thr Ala Cys Gln Gly Val Gly Gly Pro
1 5 10 15
Gly His Lys Ala
20

<210> 246
<211> 20
<212> PRT
<213> Human Immunodeficiency Virus

<400> 246
Ala Thr Leu Glu Glu Met Met Thr Ala Cys Gln Gly Val Gly Gly Pro
1 5 10 15
Gly His Lys Ala
20

<210> 247
<211> 21
<212> PRT
<213> Human Immunodeficiency Virus

<400> 247
Cys Gln Gly Val Gly Gly Pro Gly His Lys Ala Arg Val Leu Ala Glu
1 5 10 15
Ala Met Ser Gln Val
20

<210> 248

<211> 21
<212> PRT
<213> Human Immunodeficiency Virus

<400> 248
Cys Gln Gly Val Gly Gly Pro Gly His Lys Ala Arg Val Leu Ala Glu
1 5 10 15

Ala Met Ser Gln Val
20

<210> 249
<211> 20
<212> PRT
<213> Human Immunodeficiency Virus

<400> 249
Met Phe Ser Ala Leu Ser Glu Gly Ala Thr Pro Gln Asp Leu Asn Thr
1 5 10 15
Met Leu Asn Thr
20

<210> 250
<211> 20
<212> PRT
<213> Human Immunodeficiency Virus

<400> 250
Met Phe Ser Ala Leu Ser Glu Gly Ala Thr Pro Gln Asp Leu Asn Thr
1 5 10 15
Met Leu Asn Thr
20

<210> 251
<211> 20
<212> PRT
<213> Human Immunodeficiency Virus

<400> 251
Ser Ile Leu Asp Ile Arg Gln Gly Pro Lys Glu Pro Phe Arg Asp Tyr
1 5 10 15
Val Asp Arg Phe
20

<210> 252
<211> 20
<212> PRT
<213> Human Immunodeficiency Virus

<400> 252
Ser Ile Leu Asp Ile Arg Gln Gly Pro Lys Glu Pro Phe Arg Asp Tyr
1 5 10 15
Val Asp Arg Phe
20

<210> 253
<211> 20
<212> PRT
<213> Human Immunodeficiency Virus

<400> 253
Glu Pro Phe Arg Asp Tyr Val Asp Arg Phe Tyr Lys Thr Leu Arg Ala
1 5 10 15
Glu Gln Ala Ser

20

<210> 254
<211> 20
<212> PRT
<213> Human Immunodeficiency Virus

<400> 254
Glu Pro Phe Arg Asp Tyr Val Asp Arg Phe Tyr Lys Thr Leu Arg Ala
1 5 10 15
Glu Gln Ala Ser
20

<210> 255
<211> 20
<212> PRT
<213> Human Immunodeficiency Virus

<400> 255
Leu Leu Val Gln Asn Ala Asn Pro Asp Cys Lys Thr Ile Leu Lys Ala
1 5 10 15
Leu Gly Pro Ala
20

<210> 256
<211> 20
<212> PRT
<213> Human Immunodeficiency Virus

<400> 256
Leu Leu Val Gln Asn Ala Asn Pro Asp Cys Lys Thr Ile Leu Lys Ala
1 5 10 15
Leu Gly Pro Ala
20

<210> 257
<211> 20
<212> PRT
<213> Human Immunodeficiency Virus

<400> 257
Lys Thr Ile Leu Lys Ala Leu Gly Pro Ala Ala Thr Leu Glu Glu Met
1 5 10 15
Met Thr Ala Cys
20

<210> 258
<211> 20
<212> PRT
<213> Human Immunodeficiency Virus

<400> 258
Lys Thr Ile Leu Lys Ala Leu Gly Pro Ala Ala Thr Leu Glu Glu Met
1 5 10 15
Met Thr Ala Cys
20

<212> PRT

<400> 259

<210> 260

<212> PRT

<400> 260

<210> 261

<211> 20

<212> PRT

<400> 261

<210> 262

<211> 20

<212> PRT

<400> 262

<210> 263

<211> 20

<212> PRT

<400> 263

Lys Lys Tyr Lys
20

<210> 264
<211> 20
<212> PRT
<213> Human Immunodeficiency Virus

<400> 264
Leu Arg Pro Gly Gly Lys Lys Lys Tyr Lys Leu Lys His Ile Val Trp
1 5 10 15
Ala Ser Arg Glu
20

<210> 265
<211> 20
<212> PRT
<213> Human Immunodeficiency Virus

<400> 265
Leu Arg Pro Gly Gly Lys Lys Lys Tyr Lys Leu Lys His Ile Val Trp
1 5 10 15
Ala Ser Arg Glu
20

<210> 266
<211> 20
<212> PRT
<213> Human Immunodeficiency Virus

<400> 266
Leu Lys His Ile Val Trp Ala Ser Arg Glu Leu Glu Arg Phe Ala Val
1 5 10 15
Asn Pro Gly Leu
20

<210> 267
<211> 20
<212> PRT
<213> Human Immunodeficiency Virus

<400> 267
Leu Lys His Ile Val Trp Ala Ser Arg Glu Leu Glu Arg Phe Ala Val
1 5 10 15
Asn Pro Gly Leu
20

<210> 268
<211> 20
<212> PRT
<213> Human Immunodeficiency Virus

<400> 268
Leu Glu Arg Phe Ala Val Asn Pro Gly Leu Leu Glu Thr Ser Glu Gly
1 5 10 15
Cys Arg Gln Ile
20

<210> 269
<211> 20
<212> PRT
<213> Human Immunodeficiency Virus

<400> 269
Leu Glu Arg Phe Ala Val Asn Pro Gly Leu Leu Glu Thr Ser Glu Gly
1 5 10 15
Cys Arg Gln Ile
20

<210> 270
<211> 20
<212> PRT
<213> Human Immunodeficiency Virus

<400> 270
Leu Glu Thr Ser Glu Gly Cys Arg Gln Ile Leu Gly Gln Leu Gln Pro
1 5 10 15
Ser Leu Gln Thr
20

<210> 271
<211> 20
<212> PRT
<213> Human Immunodeficiency Virus

<400> 271
Leu Glu Thr Ser Glu Gly Cys Arg Gln Ile Leu Gly Gln Leu Gln Pro
1 5 10 15
Ser Leu Gln Thr
20

<210> 272
<211> 20
<212> PRT
<213> Human Immunodeficiency Virus

<400> 272
Leu Gly Gln Leu Gln Pro Ser Leu Gln Thr Gly Ser Glu Glu Leu Arg
1 5 10 15
Ser Leu Tyr Asn
20

<210> 273
<211> 20
<212> PRT
<213> Human Immunodeficiency Virus

<400> 273
Leu Gly Gln Leu Gln Pro Ser Leu Gln Thr Gly Ser Glu Glu Leu Arg
1 5 10 15
Ser Leu Tyr Asn
20

<210> 274
<211> 20
<212> PRT
<213> Human Immunodeficiency Virus

<400> 274
Gly Ser Glu Glu Leu Arg Ser Leu Tyr Asn Thr Val Ala Thr Leu Tyr
1 5 10 15
Cys Val His Gln
20

<210> 275
<211> 20
<212> PRT
<213> Human Immunodeficiency Virus

<400> 275
Gly Ser Glu Glu Leu Arg Ser Leu Tyr Asn Thr Val Ala Thr Leu Tyr
1 5 10 15
Cys Val His Gln
20

<210> 276
<211> 20
<212> PRT
<213> Human Immunodeficiency Virus

<400> 276
Thr Val Ala Thr Leu Tyr Cys Val His Gln Arg Ile Glu Ile Lys Asp
1 5 10 15
Thr Lys Glu Ala
20

<210> 277
<211> 20
<212> PRT
<213> Human Immunodeficiency Virus

<400> 277
Thr Val Ala Thr Leu Tyr Cys Val His Gln Arg Ile Glu Ile Lys Asp
1 5 10 15
Thr Lys Glu Ala
20

<210> 278
<211> 20
<212> PRT
<213> Human Immunodeficiency Virus

<400> 278
Arg Ile Glu Ile Lys Asp Thr Lys Glu Ala Leu Asp Lys Ile Glu Glu
1 5 10 15
Glu Gln Asn Lys
20

<210> 279

<211> 20
<212> PRT
<213> Human Immunodeficiency Virus

<400> 279
Arg Ile Glu Ile Lys Asp Thr Lys Glu Ala Leu Asp Lys Ile Glu Glu
1 5 10 15
Glu Gln Asn Lys
20

<210> 280
<211> 20
<212> PRT
<213> Human Immunodeficiency Virus

<400> 280
Leu Asp Lys Ile Glu Glu Glu Gln Asn Lys Ser Lys Lys Lys Ala Gln
1 5 10 15
Gln Ala Ala Ala
20

<210> 281
<211> 20
<212> PRT
<213> Human Immunodeficiency Virus

<400> 281
Leu Asp Lys Ile Glu Glu Glu Gln Asn Lys Ser Lys Lys Lys Ala Gln
1 5 10 15
Gln Ala Ala Ala
20

<210> 282
<211> 20
<212> PRT
<213> Human Immunodeficiency Virus

<400> 282
Ser Lys Lys Lys Ala Gln Gln Ala Ala Ala Asp Thr Gly His Ser Asn
1 5 10 15
Gln Val Ser Gln
20

<210> 283
<211> 20
<212> PRT
<213> Human Immunodeficiency Virus

<400> 283
Ser Lys Lys Lys Ala Gln Gln Ala Ala Ala Asp Thr Gly His Ser Asn
1 5 10 15
Gln Val Ser Gln
20

<210> 284
<211> 20

<212> PRT
<213> Human Immunodeficiency Virus

<400> 284
Asp Thr Gly His Ser Asn Gln Val Ser Gln Asn Tyr Pro Ile Val Gln
1 5 10 15
Asn Ile Gln Gly
20

<210> 285
<211> 20
<212> PRT
<213> Human Immunodeficiency Virus

<400> 285
Asp Thr Gly His Ser Asn Gln Val Ser Gln Asn Tyr Pro Ile Val Gln
1 5 10 15
Asn Ile Gln Gly
20

<210> 286
<211> 20
<212> PRT
<213> Human Immunodeficiency Virus

<400> 286
Asn Tyr Pro Ile Val Gln Asn Ile Gln Gly Gln Met Val His Gln Ala
1 5 10 15
Ile Ser Pro Arg
20

<210> 287
<211> 20
<212> PRT
<213> Human Immunodeficiency Virus

<400> 287
Asn Tyr Pro Ile Val Gln Asn Ile Gln Gly Gln Met Val His Gln Ala
1 5 10 15
Ile Ser Pro Arg
20

<210> 288
<211> 20
<212> PRT
<213> Human Immunodeficiency Virus

<400> 288
Gln Met Val His Gln Ala Ile Ser Pro Arg Thr Leu Asn Ala Trp Val
1 5 10 15
Lys Val Val Glu
20

<210> 289
<211> 20
<212> PRT

<213> Human Immunodeficiency Virus

<400> 289

Gln	Met	Val	His	Gln	Ala	Ile	Ser	Pro	Arg	Thr	Leu	Asn	Ala	Trp	Val
1				5					10					15	
Lys	Val	Val	Glu												
			20												

<210> 290

<211> 20

<212> PRT

<213> Human Immunodeficiency Virus

<400> 290

Thr	Leu	Asn	Ala	Trp	Val	Lys	Val	Val	Glu	Glu	Lys	Ala	Phe	Ser	Pro
1				5					10					15	
Glu	Val	Ile	Pro												
			20												

<210> 291

<211> 20

<212> PRT

<213> Human Immunodeficiency Virus

<400> 291

Thr	Leu	Asn	Ala	Trp	Val	Lys	Val	Val	Glu	Glu	Lys	Ala	Phe	Ser	Pro
1				5					10					15	
Glu	Val	Ile	Pro												
			20												

<210> 292

<211> 20

<212> PRT

<213> Human Immunodeficiency Virus

<400> 292

Glu	Lys	Ala	Phe	Ser	Pro	Glu	Val	Ile	Pro	Met	Phe	Ser	Ala	Leu	Ser
1				5					10					15	
Glu	Gly	Ala	Thr												
			20												

<210> 293

<211> 20

<212> PRT

<213> Human Immunodeficiency Virus

<400> 293

Glu	Lys	Ala	Phe	Ser	Pro	Glu	Val	Ile	Pro	Met	Phe	Ser	Ala	Leu	Ser
1				5					10					15	
Glu	Gly	Ala	Thr												
			20												

<210> 294

<211> 20

<212> PRT

<213> Human Immunodeficiency Virus

<400> 294

Val	Gly	Gly	His	Gln	Ala	Ala	Met	Gln	Met	Leu	Lys	Glu	Thr	Ile	Asn
1				5					10					15	
Glu	Glu	Ala	Ala												
				20											

<210> 295

<211> 20

<212> PRT

<213> Human Immunodeficiency Virus

<400> 295

Val	Gly	Gly	His	Gln	Ala	Ala	Met	Gln	Met	Leu	Lys	Glu	Thr	Ile	Asn
1				5					10					15	
Glu	Glu	Ala	Ala												
				20											

<210> 296

<211> 20

<212> PRT

<213> Human Immunodeficiency Virus

<400> 296

Leu	Lys	Glu	Thr	Ile	Asn	Glu	Glu	Ala	Ala	Glu	Trp	Asp	Arg	Val	His
1				5					10					15	
Pro	Val	His	Ala												
				20											

<210> 297

<211> 20

<212> PRT

<213> Human Immunodeficiency Virus

<400> 297

Leu	Lys	Glu	Thr	Ile	Asn	Glu	Glu	Ala	Ala	Glu	Trp	Asp	Arg	Val	His
1				5					10					15	
Pro	Val	His	Ala												
				20											

<210> 298

<211> 20

<212> PRT

<213> Human Immunodeficiency Virus

<400> 298

Glu	Trp	Asp	Arg	Val	His	Pro	Val	His	Ala	Gly	Pro	Ile	Ala	Pro	Gly
1				5					10					15	
Gln	Met	Arg	Glu												
				20											

<210> 299

<211> 20

<212> PRT

<213> Human Immunodeficiency Virus

<400> 299

Glu	Trp	Asp	Arg	Val	His	Pro	Val	His	Ala	Gly	Pro	Ile	Ala	Pro	Gly
1				5					10					15	
Gln	Met	Arg	Glu												
			20												

<210> 300

<211> 20

<212> PRT

<213> Human Immunodeficiency Virus

<400> 300

Pro	Arg	Gly	Ser	Asp	Ile	Ala	Gly	Thr	Thr	Ser	Thr	Leu	Gln	Glu	Gln
1				5				10						15	
Ile	Gly	Trp	Met												
			20												

<210> 301

<211> 20

<212> PRT

<213> Human Immunodeficiency Virus

<400> 301

Pro	Arg	Gly	Ser	Asp	Ile	Ala	Gly	Thr	Thr	Ser	Thr	Leu	Gln	Glu	Gln
1				5				10						15	
Ile	Gly	Trp	Met												
			20												

<210> 302

<211> 20

<212> PRT

<213> Human Immunodeficiency Virus

<400> 302

Ser	Thr	Leu	Gln	Glu	Gln	Ile	Gly	Trp	Met	Thr	Asn	Asn	Pro	Pro	Ile
1				5					10					15	
Pro	Val	Gly	Glu												
			20												

<210> 303

<211> 20

<212> PRT

<213> Human Immunodeficiency Virus

<400> 303

Ser	Thr	Leu	Gln	Glu	Gln	Ile	Gly	Trp	Met	Thr	Asn	Asn	Pro	Pro	Ile
1				5					10					15	
Pro	Val	Gly	Glu												
			20												

<210> 304

<211> 20

<212> PRT

<213> Human Immunodeficiency Virus

<400> 304

Thr Asn Asn Pro Pro Ile Pro Val Gly Glu Ile Tyr Lys Arg Trp Ile
1 5 10 15
Ile Leu Gly Leu
20

<210> 305

<211> 20

<212> PRT

<213> Human Immunodeficiency Virus

<400> 305

Thr Asn Asn Pro Pro Ile Pro Val Gly Glu Ile Tyr Lys Arg Trp Ile
1 5 10 15
Ile Leu Gly Leu
20

<210> 306

<211> 20

<212> PRT

<213> Human Immunodeficiency Virus

<400> 306

Ile Tyr Lys Arg Trp Ile Ile Leu Gly Leu Asn Lys Ile Val Arg Met
1 5 10 15
Tyr Ser Pro Thr
20

<210> 307

<211> 20

<212> PRT

<213> Human Immunodeficiency Virus

<400> 307

Ile Tyr Lys Arg Trp Ile Ile Leu Gly Leu Asn Lys Ile Val Arg Met
1 5 10 15
Tyr Ser Pro Thr
20

<210> 308

<211> 20

<212> PRT

<213> Human Immunodeficiency Virus

<400> 308

Asn Lys Ile Val Arg Met Tyr Ser Pro Thr Ser Ile Leu Asp Ile Arg
1 5 10 15
Gln Gly Pro Lys
20

<210> 309

<211> 20

<212> PRT

<213> Human Immunodeficiency Virus

<400> 309

Asn Lys Ile Val Arg Met Tyr Ser Pro Thr Ser Ile Leu Asp Ile Arg
1 5 10 15
Gln Gly Pro Lys
20

<210> 310
<211> 20
<212> PRT
<213> Human Immunodeficiency Virus

<400> 310
Tyr Lys Thr Leu Arg Ala Glu Gln Ala Ser Gln Glu Val Lys Asn Trp
1 5 10 15
Met Thr Glu Thr
20

<210> 311
<211> 20
<212> PRT
<213> Human Immunodeficiency Virus

<400> 311
Tyr Lys Thr Leu Arg Ala Glu Gln Ala Ser Gln Glu Val Lys Asn Trp
1 5 10 15
Met Thr Glu Thr
20

<210> 312
<211> 20
<212> PRT
<213> Human Immunodeficiency Virus

<400> 312
Gln Glu Val Lys Asn Trp Met Thr Glu Thr Leu Leu Val Gln Asn Ala
1 5 10 15
Asn Pro Asp Cys
20

<210> 313
<211> 20
<212> PRT
<213> Human Immunodeficiency Virus

<400> 313
Gln Glu Val Lys Asn Trp Met Thr Glu Thr Leu Leu Val Gln Asn Ala
1 5 10 15
Asn Pro Asp Cys
20

<210> 314
<211> 15
<212> PRT
<213> Human Immunodeficiency Virus

<400> 314
Arg Val Leu Ala Glu Ala Met Ser Gln Val Thr Asn Ser Ala Thr

1 5 10 15

<210> 315
<211> 15
<212> PRT
<213> Human Immunodeficiency Virus

<400> 315
Arg Val Leu Ala Glu Ala Met Ser Gln Val Thr Asn Ser Ala Thr
1 5 10 15

<210> 316
<211> 20
<212> PRT
<213> Human Immunodeficiency Virus

<400> 316
Thr Asn Ser Ala Thr Ile Met Met Gln Arg Gly Asn Phe Arg Asn Gln
1 5 10 15
Arg Lys Ile Val
20

<210> 317
<211> 20
<212> PRT
<213> Human Immunodeficiency Virus

<400> 317
Thr Asn Ser Ala Thr Ile Met Met Gln Arg Gly Asn Phe Arg Asn Gln
1 5 10 15
Arg Lys Ile Val
20

<210> 318
<211> 20
<212> PRT
<213> Human Immunodeficiency Virus

<400> 318
Gly Asn Phe Arg Asn Gln Arg Lys Ile Val Lys Cys Phe Asn Cys Gly
1 5 10 15
Lys Glu Gly His
20

<210> 319
<211> 20
<212> PRT
<213> Human Immunodeficiency Virus

<400> 319
Gly Asn Phe Arg Asn Gln Arg Lys Ile Val Lys Cys Phe Asn Cys Gly
1 5 10 15
Lys Glu Gly His
20

<210> 320
<211> 20
<212> PRT
<213> Human Immunodeficiency Virus

<400> 320
Lys Cys Phe Asn Cys Gly Lys Glu Gly His Thr Ala Arg Asn Cys Arg
1 5 10 15
Ala Pro Arg Lys
20

<210> 321
<211> 20
<212> PRT
<213> Human Immunodeficiency Virus

<400> 321
Lys Cys Phe Asn Cys Gly Lys Glu Gly His Thr Ala Arg Asn Cys Arg
1 5 10 15
Ala Pro Arg Lys
20

<210> 322
<211> 20
<212> PRT
<213> Human Immunodeficiency Virus

<400> 322
Thr Ala Arg Asn Cys Arg Ala Pro Arg Lys Lys Gly Cys Trp Lys Cys
1 5 10 15
Gly Lys Glu Gly
20

<210> 323
<211> 20
<212> PRT
<213> Human Immunodeficiency Virus

<400> 323
Thr Ala Arg Asn Cys Arg Ala Pro Arg Lys Lys Gly Cys Trp Lys Cys
1 5 10 15
Gly Lys Glu Gly
20

<210> 324
<211> 20
<212> PRT
<213> Human Immunodeficiency Virus

<400> 324
Ala Asn Phe Leu Gly Lys Ile Trp Pro Ser Tyr Lys Gly Arg Pro Gly
1 5 10 15
Asn Phe Leu Gln
20

<210> 325

<211> 20
<212> PRT
<213> Human Immunodeficiency Virus

<400> 325
Ala Asn Phe Leu Gly Lys Ile Trp Pro Ser Tyr Lys Gly Arg Pro Gly
1 5 10 15
Asn Phe Leu Gln
20

<210> 326
<211> 18
<212> PRT
<213> Human Immunodeficiency Virus

<400> 326
Tyr Lys Gly Arg Pro Gly Asn Phe Leu Gln Ser Arg Pro Glu Pro Thr
1 5 10 15
Ala Pro

<210> 327
<211> 18
<212> PRT
<213> Human Immunodeficiency Virus

<400> 327
Tyr Lys Gly Arg Pro Gly Asn Phe Leu Gln Ser Arg Pro Glu Pro Thr
1 5 10 15
Ala Pro

<210> 328
<211> 20
<212> PRT
<213> Human Immunodeficiency Virus

<400> 328
Ser Arg Pro Glu Pro Thr Ala Pro Pro Glu Glu Ser Phe Arg Ser Gly
1 5 10 15
Val Glu Thr Thr
20

<210> 329
<211> 20
<212> PRT
<213> Human Immunodeficiency Virus

<400> 329
Ser Arg Pro Glu Pro Thr Ala Pro Pro Glu Glu Ser Phe Arg Ser Gly
1 5 10 15
Val Glu Thr Thr
20

<210> 330
<211> 21

<212> PRT

<213> Human Immunodeficiency Virus

<400> 330

Pro	Glu	Glu	Ser	Phe	Arg	Ser	Gly	Val	Glu	Thr	Thr	Thr	Pro	Pro	Gln
1				5					10					15	
Lys	Gln	Glu	Pro	Ile											
				20											

<210> 331

<211> 21

<212> PRT

<213> Human Immunodeficiency Virus

<400> 331

Pro	Glu	Glu	Ser	Phe	Arg	Ser	Gly	Val	Glu	Thr	Thr	Thr	Pro	Pro	Gln
1				5					10					15	
Lys	Gln	Glu	Pro	Ile											
				20											

<210> 332

<211> 20

<212> PRT

<213> Human Immunodeficiency Virus

<400> 332

Thr	Thr	Pro	Pro	Gln	Lys	Gln	Glu	Pro	Ile	Asp	Lys	Glu	Leu	Tyr	Pro
1				5					10					15	
Leu	Thr	Ser	Leu												
				20											

<210> 333

<211> 20

<212> PRT

<213> Human Immunodeficiency Virus

<400> 333

Thr	Thr	Pro	Pro	Gln	Lys	Gln	Glu	Pro	Ile	Asp	Lys	Glu	Leu	Tyr	Pro
1				5					10					15	
Leu	Thr	Ser	Leu												
				20											

<210> 334

<211> 21

<212> PRT

<213> Human Immunodeficiency Virus

<400> 334

Asp	Lys	Glu	Leu	Tyr	Pro	Leu	Thr	Ser	Leu	Arg	Ser	Leu	Phe	Gly	Asn
1				5					10					15	
Asp	Pro	Ser	Ser	Gln											
				20											

<210> 335

<211> 21

<212> PRT

<213> Human Immunodeficiency Virus

<400> 335

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Asp Lys Glu Leu Tyr Pro Leu Thr Ser Leu Arg Ser Leu Phe Gly Asn
 1             5             10             15
Asp Pro Ser Ser Gln
                20

```

<210> 336

<211> 20

<212> PRT

<213> Simian Immunodeficiency Virus

<400> 336

```

Ala Thr Glu Thr Leu Ala Gly Ala Trp Gly Asp Leu Trp Glu Thr Leu
 1             5             10             15
Arg Arg Gly Gly
                20

```

<210> 337

<211> 20

<212> PRT

<213> Simian Immunodeficiency Virus

<400> 337

```

Asp Leu Trp Glu Thr Leu Arg Arg Gly Gly Arg Trp Ile Leu Ala Ile
 1             5             10             15
Pro Arg Arg Ile
                20

```

<210> 338

<211> 19

<212> PRT

<213> Simian Immunodeficiency Virus

<400> 338

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Arg Trp Ile Leu Ala Ile Pro Arg Arg Ile Arg Gln Gly Leu Glu Leu
 1             5             10             15
Thr Leu Leu

```

<210> 339

<211> 500

<212> PRT

<213> Human Immunodeficiency Virus

<400> 339

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Met Gly Ala Arg Ala Ser Val Leu Ser Gly Gly Glu Leu Asp Arg Trp
 1             5             10             15
Glu Lys Ile Arg Leu Arg Pro Gly Gly Lys Lys Lys Tyr Lys Leu Lys
                20             25             30
His Ile Val Trp Ala Ser Arg Glu Leu Glu Arg Phe Ala Val Asn Pro
                35             40             45
Gly Leu Leu Glu Thr Ser Glu Gly Cys Arg Gln Ile Leu Gly Gln Leu
                50             55             60
Gln Pro Ser Leu Gln Thr Gly Ser Glu Glu Leu Arg Ser Leu Tyr Asn
 65             70             75             80

```

Thr	Val	Ala	Thr	Leu	Tyr	Cys	Val	His	Gln	Arg	Ile	Glu	Ile	Lys	Asp	
				85					90					95		
Thr	Lys	Glu	Ala	Leu	Asp	Lys	Ile	Glu	Glu	Gln	Asn	Lys	Ser	Lys		
			100					105				110				
Lys	Lys	Ala	Gln	Gln	Ala	Ala	Ala	Asp	Thr	Gly	His	Ser	Asn	Gln	Val	
		115					120					125				
Ser	Gln	Asn	Tyr	Pro	Ile	Val	Gln	Asn	Ile	Gln	Gly	Gln	Met	Val	His	
	130					135					140					
Gln	Ala	Ile	Ser	Pro	Arg	Thr	Leu	Asn	Ala	Trp	Val	Lys	Val	Val	Glu	
145					150					155					160	
Glu	Lys	Ala	Phe	Ser	Pro	Glu	Val	Ile	Pro	Met	Phe	Ser	Ala	Leu	Ser	
			165						170					175		
Glu	Gly	Ala	Thr	Pro	Gln	Asp	Leu	Asn	Thr	Met	Leu	Asn	Thr	Val	Gly	
			180					185					190			
Gly	His	Gln	Ala	Ala	Met	Gln	Met	Leu	Lys	Glu	Thr	Ile	Asn	Glu	Glu	
		195				200						205				
Ala	Ala	Glu	Trp	Asp	Arg	Val	His	Pro	Val	His	Ala	Gly	Pro	Ile	Ala	
	210					215					220					
Pro	Gly	Gln	Met	Arg	Glu	Pro	Arg	Gly	Ser	Asp	Ile	Ala	Gly	Thr	Thr	
225					230					235					240	
Ser	Thr	Leu	Gln	Glu	Gln	Ile	Gly	Trp	Met	Thr	Asn	Asn	Pro	Pro	Ile	
			245					250						255		
Pro	Val	Gly	Glu	Ile	Tyr	Lys	Arg	Trp	Ile	Ile	Leu	Gly	Leu	Asn	Lys	
		260						265					270			
Ile	Val	Arg	Met	Tyr	Ser	Pro	Thr	Ser	Ile	Leu	Asp	Ile	Arg	Gln	Gly	
		275					280					285				
Pro	Lys	Glu	Pro	Phe	Arg	Asp	Tyr	Val	Asp	Arg	Phe	Tyr	Lys	Thr	Leu	
	290					295					300					
Arg	Ala	Glu	Gln	Ala	Ser	Gln	Glu	Val	Lys	Asn	Trp	Met	Thr	Glu	Thr	
305					310					315					320	
Leu	Leu	Val	Gln	Asn	Ala	Asn	Pro	Asp	Cys	Lys	Thr	Ile	Leu	Lys	Ala	
			325						330					335		
Leu	Gly	Pro	Ala	Ala	Thr	Leu	Glu	Glu	Met	Met	Thr	Ala	Cys	Gln	Gly	
		340						345					350			
Val	Gly	Gly	Pro	Gly	His	Lys	Ala	Arg	Val	Leu	Ala	Glu	Ala	Met	Ser	
	355						360					365				
Gln	Val	Thr	Asn	Ser	Ala	Thr	Ile	Met	Met	Gln	Arg	Gly	Asn	Phe	Arg	
	370					375					380					
Asn	Gln	Arg	Lys	Ile	Val	Lys	Cys	Phe	Asn	Cys	Gly	Lys	Glu	Gly	His	
385					390					395					400	
Thr	Ala	Arg	Asn	Cys	Arg	Ala	Pro	Arg	Lys	Lys	Gly	Cys	Trp	Lys	Cys	
			405						410					415		
Gly	Lys	Glu	Gly	His	Gln	Met	Lys	Asp	Cys	Thr	Glu	Arg	Gln	Ala	Asn	
		420						425					430			
Phe	Leu	Gly	Lys	Ile	Trp	Pro	Ser	Tyr	Lys	Gly	Arg	Pro	Gly	Asn	Phe	
	435						440					445				
Leu	Gln	Ser	Arg	Pro	Glu	Pro	Thr	Ala	Pro	Pro	Glu	Glu	Ser	Phe	Arg	
	450					455					460					
Ser	Gly	Val	Glu	Thr	Thr	Thr	Pro	Pro	Gln	Lys	Gln	Glu	Pro	Ile	Asp	
465					470					475					480	
Lys	Glu	Leu	Tyr	Pro	Leu	Thr	Ser	Leu	Arg	Ser	Leu	Phe	Gly	Asn	Asp	
			485						490					495		
Pro	Ser	Ser	Gln													
			500													

<210> 340

<211> 879

<212> PRT

<213> Simian Immunodeficiency Virus

<400> 340

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Met Gly Cys Leu Gly Asn Gln Leu Leu Ile Ala Ile Leu Leu Leu Ser
1      5      10      15
Val Tyr Gly Thr Tyr Cys Thr Leu Tyr Val Thr Val Phe Tyr Gly Val
20      25      30
Pro Ala Trp Arg Asn Ala Thr Ile Pro Leu Phe Cys Ala Thr Lys Asn
35      40      45
Arg Asp Thr Trp Gly Thr Thr Gln Cys Leu Pro Asp Asn Gly Asp Tyr
50      55      60
Ser Glu Leu Ala Leu Asn Val Thr Glu Ser Phe Asp Ala Trp Asn Asn
65      70      75      80
Thr Val Thr Glu Gln Ala Ile Glu Asp Val Trp Gln Leu Phe Glu Thr
85      90      95
Ser Ile Lys Pro Cys Val Lys Leu Ser Pro Leu Cys Ile Thr Met Arg
100     105     110
Cys Asn Lys Ser Glu Thr Asp Arg Trp Gly Leu Thr Lys Ser Ile Thr
115     120     125
Thr Thr Ala Ser Thr Thr Ser Thr Thr Ala Ser Ala Lys Val Asp Met
130     135     140
Val Asn Glu Thr Ser Ser Cys Ile Ala Gln Asp Asn Cys Thr Gly Leu
145     150     155     160
Glu Gln Glu Gln Met Ile Ser Cys Lys Phe Asn Met Thr Gly Leu Lys
165     170     175
Arg Asp Lys Lys Lys Glu Tyr Asn Glu Thr Trp Tyr Ser Ala Asp Leu
180     185     190
Val Cys Glu Gln Gly Asn Ser Thr Gly Asn Glu Ser Arg Cys Tyr Met
195     200     205
Asn His Cys Asn Thr Ser Val Ile Gln Glu Ser Cys Asp Lys His Tyr
210     215     220
Trp Asp Ala Ile Arg Phe Arg Tyr Cys Ala Pro Pro Gly Tyr Ala Leu
225     230     235     240
Leu Arg Cys Asn Asp Thr Asn Tyr Ser Gly Phe Met Pro Lys Cys Ser
245     250     255
Lys Val Val Val Ser Ser Cys Thr Arg Met Met Glu Thr Gln Thr Ser
260     265     270
Thr Trp Phe Gly Phe Asn Gly Thr Arg Ala Glu Asn Arg Thr Tyr Ile
275     280     285
Tyr Trp His Gly Lys Asp Asn Arg Thr Ile Ile Ser Leu Asn Lys Tyr
290     295     300
Tyr Asn Leu Thr Ile Lys Cys Arg Arg Pro Gly Asn Lys Thr Val Leu
305     310     315     320
Pro Val Thr Ile Met Ser Gly Leu Val Phe His Ser Gln Pro Ile Asn
325     330     335
Asp Arg Pro Lys Gln Ala Trp Cys Trp Phe Gly Gly Lys Trp Lys Asp
340     345     350
Ala Ile Lys Glu Val Lys Gln Thr Ile Val Lys His Pro Arg Tyr Thr
355     360     365
Gly Thr Asn Asp Thr Ala Arg Ile Asn Leu Thr Ala Pro Gly Gly Gly
370     375     380
Asp Pro Glu Val Thr Phe Met Trp Thr Asn Cys Arg Gly Glu Phe Leu
385     390     395     400
Tyr Cys Lys Met Asn Trp Phe Leu Asn Trp Val Glu Asp Arg Asn Thr
405     410     415
Thr Asn Gln Lys Pro Lys Glu Gln Tyr Lys Arg Asn Tyr Val Pro Cys
420     425     430
His Ile Arg Gln Ile Ile Asn Thr Trp His Lys Val Gly Lys Asn Val
435     440     445
Tyr Leu Pro Pro Arg Glu Gly Asp Leu Thr Cys Asn Ser Thr Val Thr
450     455     460
Ser Leu Ile Ala Asn Ile Asp Trp Ile Asp Gly Asn Gln Thr Asn Ile
465     470     475     480

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Thr	Met	Ser	Ala	Glu	Val	Ala	Glu	Leu	Tyr	Arg	Leu	Glu	Leu	Gly	Asp	485	490	495
Tyr	Lys	Leu	Val	Glu	Ile	Thr	Pro	Ile	Gly	Leu	Ala	Pro	Thr	Asn	Val	500	505	510
Lys	Arg	Tyr	Thr	Thr	Gly	Gly	Thr	Ser	Arg	Asn	Lys	Arg	Gly	Val	Phe	515	520	525
Val	Leu	Gly	Phe	Leu	Gly	Phe	Leu	Ala	Thr	Ala	Gly	Ser	Ala	Met	Gly	530	535	540
Ala	Ala	Ser	Leu	Thr	Leu	Thr	Ala	Gln	Ser	Arg	Thr	Leu	Leu	Ala	Gly	545	550	555
Ile	Val	Gln	Gln	Gln	Gln	Gln	Leu	Leu	Asp	Val	Val	Lys	Arg	Gln	Gln	565	570	575
Glu	Leu	Leu	Arg	Leu	Thr	Val	Trp	Gly	Thr	Lys	Asn	Leu	Gln	Thr	Arg	580	585	590
Val	Thr	Ala	Ile	Glu	Lys	Tyr	Leu	Lys	Asp	Gln	Ala	Gln	Leu	Asn	Ala	595	600	605
Trp	Gly	Cys	Ala	Phe	Arg	Gln	Val	Cys	His	Thr	Thr	Val	Pro	Trp	Pro	610	615	620
Asn	Thr	Ser	Leu	Thr	Pro	Lys	Trp	Asp	Asn	Glu	Thr	Trp	Gln	Glu	Trp	625	630	635
Glu	Arg	Lys	Val	Asp	Phe	Leu	Glu	Glu	Asn	Ile	Thr	Ala	Leu	Pro	Glu	645	650	655
Glu	Ala	Gln	Ile	Gln	Gln	Glu	Lys	Asn	Met	Tyr	Glu	Leu	Gln	Lys	Leu	660	665	670
Asn	Ser	Trp	Asp	Val	Phe	Gly	Asn	Trp	Phe	Asp	Leu	Ala	Ser	Trp	Ile	675	680	685
Lys	Tyr	Ile	Gln	Tyr	Gly	Val	Tyr	Ile	Val	Val	Gly	Val	Ile	Leu	Leu	690	695	700
Arg	Ile	Val	Ile	Tyr	Ile	Val	Gln	Met	Leu	Ala	Lys	Leu	Arg	Gln	Gly	705	710	715
Tyr	Arg	Pro	Val	Phe	Ser	Ser	Pro	Pro	Ser	Tyr	Phe	Gln	Gln	Thr	His	725	730	735
Ile	Gln	Gln	Asp	Pro	Ala	Leu	Pro	Thr	Arg	Glu	Gly	Lys	Glu	Gly	Asp	740	745	750
Gly	Gly	Glu	Gly	Asp	Gly	Asn	Ser	Ser	Trp	Pro	Trp	Gln	Ile	Glu	Tyr	755	760	765
Ile	His	Leu	Leu	Ile	Arg	Gln	Leu	Ile	Arg	Leu	Leu	Thr	Trp	Leu	Phe	770	775	780
Ser	Asn	Cys	Arg	Thr	Leu	Leu	Ser	Arg	Val	Tyr	Gln	Ile	Leu	Gln	Pro	785	790	795
Ile	Leu	Gln	Arg	Leu	Ser	Ala	Thr	Leu	Gln	Arg	Ile	Arg	Glu	Val	Leu	805	810	815
Arg	Thr	Glu	Leu	Thr	Tyr	Leu	Gln	Tyr	Gly	Trp	Ser	Tyr	Phe	His	Glu	820	825	830
Ala	Val	Gln	Ala	Ala	Trp	Arg	Ser	Ala	Thr	Glu	Thr	Leu	Ala	Gly	Ala	835	840	845
Trp	Gly	Asp	Leu	Trp	Glu	Thr	Leu	Arg	Arg	Gly	Gly	Arg	Trp	Ile	Leu	850	855	860
Ala	Ile	Pro	Arg	Arg	Ile	Arg	Gln	Gly	Leu	Glu	Leu	Thr	Leu	Leu		865	870	875